OCTOBER 2008 MAMMOTH CREEK FISH COMMUNITY SURVEY

Prepared for:
Mammoth Community Water District
P.O. Box 597
Mammoth Lakes, California 93546

FINAL REPORT

Prepared by:

Tim Salamunovich
Thomas R. Payne & Associates
P.O. Box 4678
890 L Street
Arcata, California 95521
(707) 822-8478

January 16, 2009

Table of Contents

List of Figures and Tables

Figures

Tables

List of Appendices

Appendix

Introduction

Since 1992, the fish populations in Mammoth Creek have been systematically surveyed annually each fall (except for 1998) to evaluate the efficacy of the existing bypass flows in maintaining the fish populations throughout the lower basin (Hood 1998, 2001, 2002, 2003, 2004, 2006a, 2006b; Hood et al. 1992, 1993, 1994; Jenkins 1999; Jenkins and Dawson 1996, 1997; Salamunovich 2006, 2007). This report presents the results of the latest monitoring effort. The specific objectives of the October 2008 fish community survey were to characterize fishery population (e.g., species composition, abundance, biomass, length frequencies, etc.) at each of the historic Mammoth Creek fish sampling stations and to compare the results of the 2008 survey with those from previous annual surveys.

Study Area/Study Sites

Mammoth Creek drains the Mammoth Crest and several high elevation lakes on the eastern side of the southern Sierra Nevada in Mono County, California. Mammoth Creek basin has a drainage area of about 71 square miles (California Department of Water Resources 1973). Basin elevations range from about 11,000 feet in the headwaters along the Mammoth Crest to 7,000 feet at the Chance Ranch near its confluence with Hot Creek.

Mammoth Creek is part of the Owens Subprovince of the Great Basin Province (Moyle 2002). The original native fish fauna likely consisted of two species, the Owens sucker (*Catostomus fumeiventris*) and the Owens tui chub (*Gila bicolor snyderi*). The tui chub that now inhabit the lower portion of Mammoth Creek appear to be hybrid forms resulting from crosses with Lahontan tui chub (*G. b. obesa*) that were presumably introduced as baitfish in the 1960's (Chen et al. 2006). Historically, trout were absent from the Owens River watershed, which includes Mammoth Creek (Needham and Cramer 1943; Moyle et al. 1996). It is unknown when rainbow trout (*Oncorhynchus mykiss*) were introduced into the basin, but brown trout (*Salmo trutta*) were likely introduced in the 1890's (Jenkins et al. 1999). Both species have established naturalized populations in Mammoth Creek. In addition to the naturalized rainbow trout, Mammoth Creek populations are supplemented through regular plants of hatchery rainbow trout made by California Department of Fish and Game (CDFG). The rainbow trout are planted at 12 to 15 locations along Mammoth Creek from Minaret Road (0.3 miles downstream of Site BL) to the Mammoth Creek Flume area (Site EL). Prior to 2007, the CDFG Hot Creek Hatchery planted an average of over 13,000 catchable-sized rainbow trout each year (Table 1). The Hot Creek Hatchery trout fish were planted about once a week throughout the trout fishing season (late April through mid-October).

Table 1. Levels of catchable-sized rainbow trout stocked in Mammoth Creek for past five years. Data provided by CDFG.

Year	Number	Pounds	Average weight/fish (pounds)
2004	12,426	7,367	0.89
2005	13,109	7,200	0.55
2006	14,583	7,250	0.54
2007	6,917	4,060	0.68
2008	9,326	5,330	0.57
Average	11,272	6,241	0.67

New Zealand mud snails ([NZMS], *Potamopyrgus antipodarum*) are known to occur in Hot Creek below the CDFG Hot Creek State Fish Hatchery. This known infestation site is located near its confluence with Mammoth Creek. In 2007, an infestation of NZMS at the Hot Creek Hatchery forced a discontinuation of that facility's Mammoth Creek planting program (Judy Urrutia, personal communication). Since 2007, the hatchery rainbow trout supplementation in Mammoth Creek has been conducted by CDFG's Mt. Whitney and Fish Springs hatcheries. The numbers, poundage, and frequency of the hatchery supplementation to Mammoth Creek have been lower since the change in hatchery jurisdiction (Table 1).

The fish survey project area consists of the lower 8.9 miles of Mammoth Creek from the Sherwin Street crossing in the town of Mammoth Lakes downstream to its confluence with

Hot Creek (Figure1). The fish survey project area has been divided into four distinct reaches based upon an analysis conducted by Beak Consultants (Bratovich et al. 1990). The characteristics of aquatic habitat vary considerably among the four study reaches based upon the combination of channel morphology, riparian vegetation, stream gradient, and bed substrate size and composition. Channel braiding occurs in each study reach and is a result of large woody debris accumulation in lower gradient sections of the channel.

The experimental design and rationale for the original selection of the fish survey sample sites are described in detail in Bratovich et al. (1990). Distinct differences in the amount of riparian cover within each study reach were observed during the original habitat mapping survey conducted in 1988 (Bratovich et al. 1990). To ensure representation of riparian cover and dispersion of sampling sections, fish sampling stations were originally located within "high" and "low" density riparian habitat sites within each study reach. For example, Site BH represents high-density riparian cover habitat site within Reach B, while Site EL represents a low-density riparian cover site in Reach E. Discretion must be used when comparing and interpreting the results between high and low-density riparian cover sites because of between reach variation in riparian density and tree species and changes in the riparian area over time.

Consistent with previous surveys, eight stations of approximately 300 feet in length were sampled in October 2008, with each site representing a high or low-density riparian vegetation cover habitat within the four study reaches (Figure 1). While over the years several of the sample sites have been moved up or downstream due to changes in landowner access or channel morphology, the habitat areas have remained unchanged (Hood 2006b). The sites sampled in 2008 were identical to those sampled in both 2006 and 2007, and were easily identified by photographs, rebar monument stakes, and high visibility surveyors flagging tape left behind from previous surveys. In addition, Mammoth Community Water district (MCWD) personnel recorded the latitude and longitude of the top and bottom boundaries at each of the eight sample stations using a Trimble® backpack differential global positioning system.

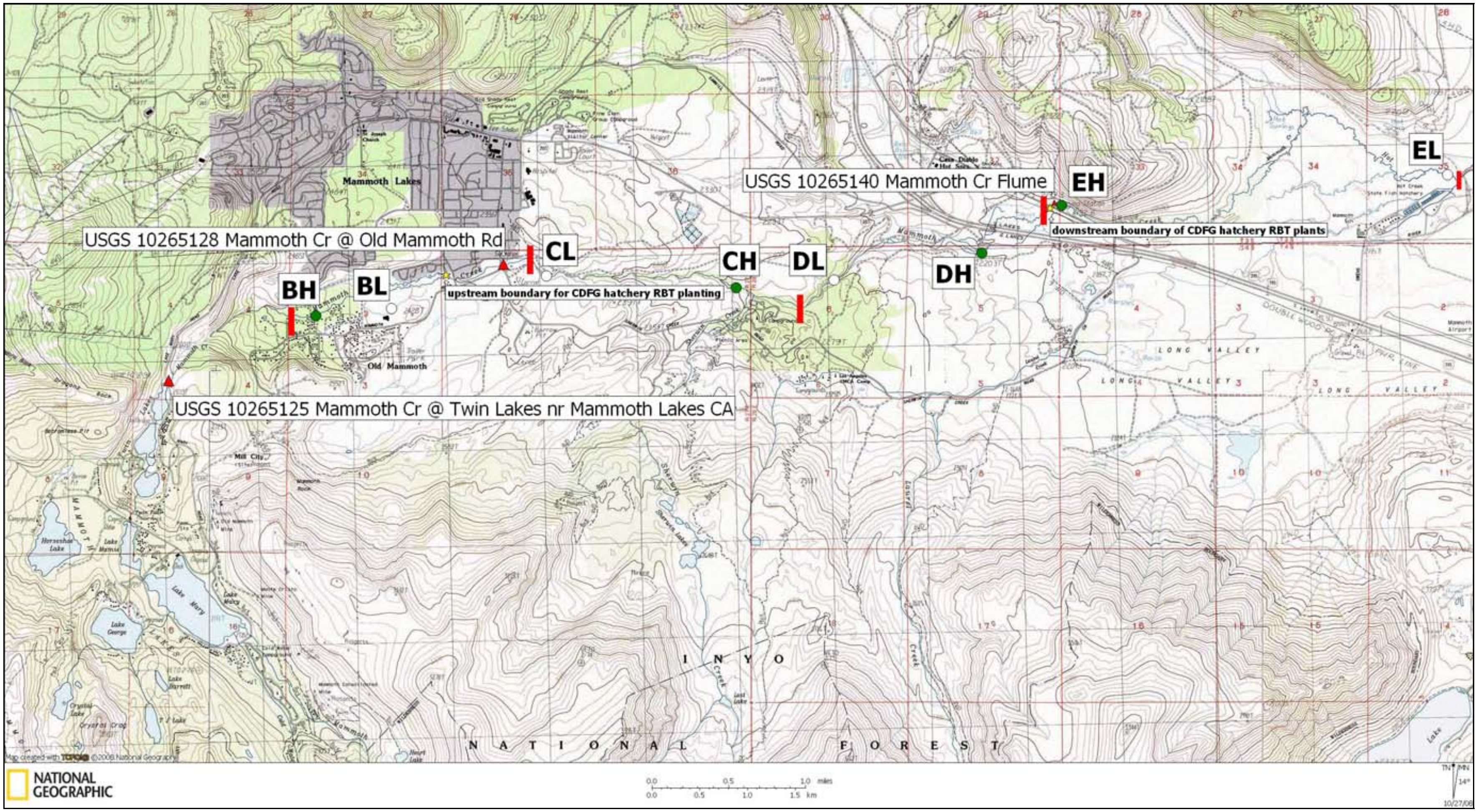


Figure 1. Map showing Mammoth Creek basin and location of the eight fish sampling sites. Red hashes show reach boundaries. Green dots are high riparian density fish samples sites, white dots are low riparian density sites. Red triangles show stream flow gage locations.

Methods

Physical Site Data Collection

Habitat dimensions, habitat characteristics, and water quality parameters were measured at all electrofishing sites at the time they were sampled. All data were recorded on standardized data forms. The length of each site was measured to the nearest foot from the bottom boundary to the top boundary using a hip chain. The top and bottom boundaries along each bank were marked using high-visibility surveyors flagging.

Stream width to the nearest 0.1 foot was measured at a minimum of eleven locations along the sampling station using a surveyors tape. The average of these measurements was used to determine the mean width at each station, which was used in combination with reach length to estimate a total sample area. Depth measurements (to the nearest 0.05 foot) were made using a survey stadia rod at ¼, ½, and ¾ distance across each of the width cross-sections to estimate the average depth for the entire sample station. The maximum depth within each of the stations was also recorded using the deepest reading made within the particular survey unit. Stream gradient, which had been measured in previous years, was not re-measured in 2008 since this parameter is considered relatively stable.

Habitat characteristics within each of the survey stations were also recorded at the time of sampling. The percentages of different habitat types (pool, run, riffle, or pocket water) comprising the station were visually estimated, along with the percentages of various substrate types by particle size (fines [<2mm], sand [2-7mm], gravel [8-75mm], cobble [76-300mm], boulder [>300 mm] and bedrock). The percent of the site available as fish cover was also estimated using the categories of surface turbulence, instream object cover, undercut bank, and overhanging vegetation within 48 inches of the water surface. These cover types often overlap and so total cover may sum to more than 100 percent. The surface area of suitable trout spawning gravels in the study site was also estimated.

Water temperature was recorded at the time the stations were sampled. Other water quality parameters were also measured, including pH, conductivity (µS/cm), specific conductivity (temperature standardized conductivity), salinity (ppt), and dissolved oxygen concentrations (mg/L), and percent saturation. The pH measurements were made using a Tetratest® pH freshwater kit available at most aquarium stores. The remaining water quality parameters were measured using Yellow Spring Instruments® handheld meters (Models 30 and 550).

Electrofishing

Estimation of the abundance and population characteristics of resident fish in Mammoth Creek was conducted using multiple-pass removal-depletion by backpack electrofishing. The study sites were isolated with $^3/_8$-inch (9.5 mm) mesh block nets to prevent immigration or emigration of fish during sampling. Two shockers assisted by two netters moved upstream in concert across a unified front during each sampling pass. The shockers used portable backpack electrofishers (Smith-Root® Models 11A and 12A) to stun fish, which were captured by the netters using ⅛-inch mesh dip nets. All captured fish were removed to 5-gallon live buckets filled with river water and equipped with a small bait bucket aerators. Fish in the live buckets were periodically transferred to a ⅛-inch mesh netted live box located in the river outside of the study site and away from the electric field.

A minimum of three passes of equal effort were made by the electrofishing teams within each reach. The target for the three-pass data was a population estimate for the dominant trout species with a standard error that was ten percent (or less) of that estimate. After the third pass, the trout capture data was used to generate the population statistics on a laptop computer using MicroFish 3.0 (Van Deventer and Platts 1989). If the population estimate and standard error criterion was met, no additional passes were made. If the criterion was not met, another pass would be made and the new estimate and standard error would be re-evaluated.

Following each pass, captured fish were identified, measured and weighed. Prior to handling, fish were anesthetized in a weak CO_2 solution using commercially available effervescent pain-relief tablets (two tablets: ¾ gallons of clean river water). All fish were measured to the nearest millimeter fork length (FL) and weighed to the nearest 0.1 gram on an electronic scale. Fish measurement data and notes were recorded on standardized data sheets.

During processing, fish were inspected for any distinguishing marks (fin clips) or features (e.g. hook scars, deformed fins, tumors; fungus, etc.), which were duly noted on the data sheets. All rainbow trout were examined for physical evidence of hatchery origin, such as frayed or deformed fins, missing adipose fins, or abraded skin on snouts or backs. Rainbow trout showing such signs were designated as hatchery rainbow trout. Those rainbow trout not showing these characteristics were considered "wild" rainbow trout. All mortalities were also noted on the data sheets.

After processing, fish were placed in an aerated bucket of cool river water and allowed to recover. Fish in the recovery bucket were regularly transferred to ⅛-inch mesh net floating nylon fish bags located in the river outside the study site. All fish were held in the live bags until fully recovered from the shocking and handling. After the completion of the survey, all fish were distributed back to size-appropriate habitat areas of the study site.

The length data was used to generate site-specific length-frequency histograms for each species. These plots show the size structure of the population, which tends to be related to the age structure of the specific population.

The multiple-pass capture data were used to generate a population estimate and 95 percent confidence interval for each species using the maximum-likelihood estimator from the microcomputer software program MicroFish 3.0 (Van Deventer and Platts 1989). MicroFish 3.0 cannot provide a population estimate if only a single fish is captured from all passes combined, or if all the fish are captured on the first pass. In these rare cases, the Zippin estimator from the software program CAPTURE (White et al. 1978) was used to calculate the population estimate and associated error. Both software programs generate probability-of-capture estimates based upon capture patterns. The capture probability estimate, which varies between zero and one, is a measure of sampling efficiency, with values greater than 0.40 being generally indicative of effective sampling (White et al. 1982).

Fulton's Condition Factor (K) was calculated for all trout using the formula of Bagenal and Tesch (1978). The condition factor compares the length and weight relationship of individual fish to assess their physical condition (Everhart et al. 1975). Higher condition factors indicate heavier fish for a given length. A value of 1.0 is generally considered normal for a healthy population of trout.

The population estimate data was used to generate abundance and biomass estimates. The abundance estimates were standardized to common indices (fish/mile and fish/acre) to facilitate comparisons between unequal length/area sites within and between years. Biomass estimates for each species at each station were calculated as the product of the estimated fish population and the mean weight of that species captured during electrofishing divided by the surface area of the river at sampled at that site. Biomass estimates were also calculated using several indices (e.g. pounds/mile and pounds/acre) to facilitate comparison with earlier surveys. Biomass is a more meaningful production index, since it takes into account both fish numbers and fish size (as indicated by weight).

In order to prevent contamination of field equipment with NZMS and their inadvertent spread within the Mammoth Creek basin, several precautionary measures were used during the survey. First, during 2008 the surveys were conducted in a downstream direction (i.e. began at the most upstream site at Sherwin Road in town and ended near the mouth of Mammoth Creek near the Hot Creek Hatchery, the area with the greatest NZMS risk. This simple approach prevents the inadvertent contamination of upstream “snail-free” sites with equipment brought from downstream sites, where there is greater risk of NZMZ contamination. In addition, all gear was thoroughly rinsed and cleaned of vegetation and sediment at each site.

We tried to minimize any exposure risks at the lower EL Site (near the hatchery and a known NZMS locale) by using the hatchery foot bridge to cross over Hot Creek. Following sampling at Site EL, all gear was rinsed off and scrubbed with coarse-bristle brushes before leaving the site, and then hosed-off and scrubbed again at the MCWD office. After this final rinsing, all gear that was potentially exposed to NZMS (block nets, dip nets, anode rings and poles, waders, boots, live carts, block net poles, and buckets were left outside for 14 to 15 hours in air temperatures that were 15° to 27° Fahrenheit. All gear was thoroughly frozen during this period and prior to travelling from the project area. NZMS are killed if exposed to freezing temperatures for 6-8 hours (Hosea and Finlayson 2005).

Results

The electrofishing surveys of the eight Mammoth Creek study sites were conducted over four consecutive days from October 8-11, 2008. Stream flows in the upper portion of the study reach as measured at the Old Mammoth Road stream gage averaged 5.3 cubic feet per second (cfs) during this period and were about 25% lower than stream flow during the Fall 2007 sampling and almost 55% lower than flows sampled in 2006 (Figure 2). The average stream flow in the lower basin (i.e. downstream of Sherwin Creek) as recorded at the Los Angeles Department of Water & Power stream gage below Highway 395 was slightly lower at 5.2 cfs during the 2008 sample period (MCWD, unpublished data).

Physical Site Data Collection

The habitat and water quality measurements were conducted at each site following the first electrofishing pass while the remaining crews were processing the captured fish. Copies of the actual data sheets are contained in Appendix A. A summary of the habitat dimensions (i.e. lengths, widths, and depths), water quality parameters, and habitat characteristics (i.e. habitat types, substrate types, and cover types) are presented in Table 2. Site locations are shown on Figure 1.

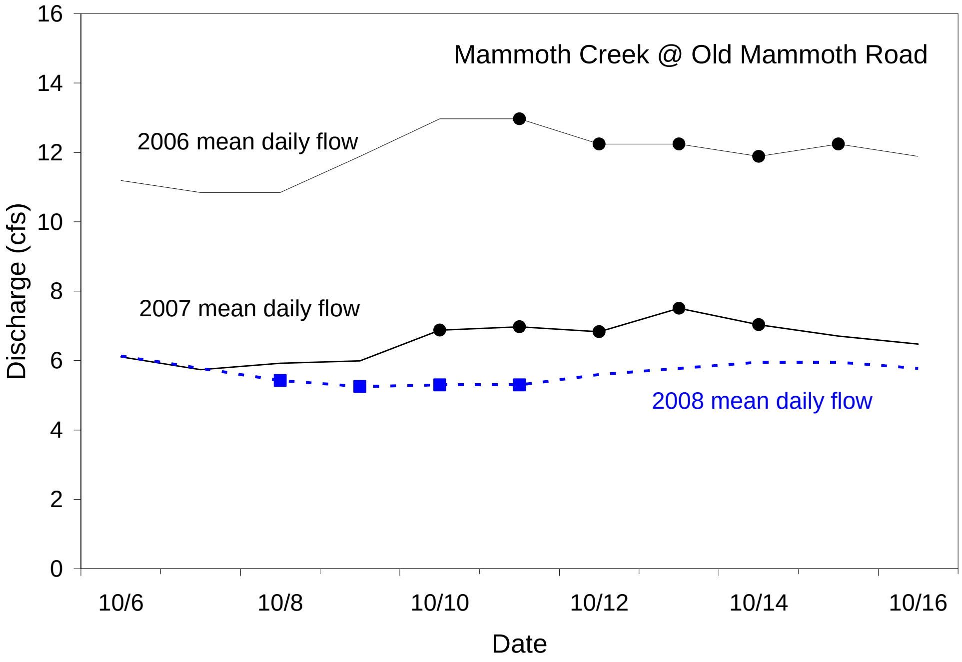


Figure 2. Stream flow records for Mammoth Creek at Old Mammoth Road crossing (near Site CL) during the 2006, 2007, and 2008 fish surveys. Dark markers show actual fish sampling dates for each year. Data provided by MCWD.

By the time of the early October 2008 sampling, water temperatures were relatively cool (<50°F), while dissolved oxygen concentrations were relatively high (>8.0 mg/L) at most of the study sites (Table 2). The combination of cool water temperature and high dissolved oxygen levels likely contributed to the low electrofishing/handling mortality noted during the 2008 survey (0.8 percent for trout).

Table 2. Summary of habitat and water quality measurements at each of the eight Mammoth Creek electrofishing sites, October 2008.

	BH	BL	CH	CL	DH	DL	EH	EL
HABITAT MEASUREMENTS								
Sample date	8 Oct	8 Oct	9 Oct	9 Oct	10 Oct	10 Oct	11 Oct	11 Oct
Length (ft)	308	306	306	318	333	295	294	308
Mean width (ft)	12.9	8.8	13.0	20.1	10.2	16.3	17.4	15.0
Mean depth (ft)	0.52	0.36	0.88	0.79	0.99	0.75	0.69	0.93
Maximum depth (ft)	2.70	0.75	2.45	2.35	2.70	2.40	1.80	2.70
Surface Area (ft^2)	3,976.0	2,6778.9	3,969.7	6,388.9	3,381.5	4,797.8	5,107.6	4,620.0
Gradient (%)*	1.86	1.59	3.14	1.40	0.57	2.87	0.74	0.29
WATER QUALITY MEASUREMENTS								
Water temperature (°F)	43.9	51.6	43.9	49.1	39.9	37.9	32.4	38.5
Conductivity (µS/cm)	127.3	143.1	129.0	198.6	100.0	97.3	80.0	106.6
pH	7.5	8.0	8.0	8.0	8.0	8.0	7.5	7.5
Dissolved Oxygen (mg/L)	7.41	8.13	9.04	8.24	9.62	10.20	11.37	11.06
Dissolved Oxygen (% saturation)	62.8	74.1	74.2	72.6	74.6	76.7	78.5	83.9
HABITAT TYPES								
% pool	10	5	15	30	25	40	10	30
% run	40	45	60	30	70	25	70	50
% riffle	50	50	20	25	5	35	20	20
% pocket water	0	0	5	15	0	0	0	0
SUBSTRATE TYPES								
% fines (<2 mm)	5	5	5	5	5	5	10	15
% sands (2 – 7 mm)	5	5	5	10	10	5	10	10
% gravel (7 - 75 mm)	20	75	15	10	25	20	35	50
% cobble (75 - 300 mm)	55	10	40	35	45	40	40	20
% boulder (>300 mm)	15	5	35	40	15	25	5	5
% bedrock	0	0	0	0	0	5	0	0
TROUT SPAWNING								
Surface area (ft^2)	379	1,741	80	296	656	135	379	1,727
COVER TYPES								
% surface turbulence	25	5	5	20	15	20	5	5
% instream object	20	5	45	55	15	45	10	5
% undercut bank	5	5	10	10	5	30	20	20
% overhanging vegetation (<48”)	35	15	35	30	45	30	40	5

* stream gradients were measured in October 2007

Our experience has shown that water conductivities in the 70-150 µS/cm are ideal for effective backpack electrofishing. The water conductivity measured at all sites was within or near this range (Table 2).

Site BH

This 308-foot long high-density riparian habitat site was located in the town of Mammoth Lakes just downstream of the Sherwin Street crossing (Figure 1). The culvert at Sherwin Street, which marked the upstream boundary of the survey site, appeared to have been recently replaced. This site was located within a braided section of Mammoth Creek and so carried only a portion of the stream flow. During our survey, this site had a mean width of 12.9 feet and a mean depth of 0.52 feet and was predominantly riffle and run habitat (Table 2). The site had a relatively low gradient (1.9 percent) and the substrate was dominated by cobble and gravel. About 379 ft^2 of suitable trout spawning gravel deposits were noted in the low flow channel at this site during our survey. Surface turbulence, instream object, and overhanging vegetation were identified as the dominant cover types.

Site BL

This 306-foot long low-density riparian cover habitat site was located in the town of Mammoth Lakes just downstream of the Snow Creek Condominiums access road crossing (Figure 1). This site was located within a braided section of Mammoth Creek and so carried only a portion of the stream flow. During our survey, this site had a mean width of 8.8 feet and a mean depth of 0.36 feet and was predominantly shallow riffle and run habitat (Table 2). The site had a relatively low gradient (1.6 percent) and the stream bed was dominated by gravel substrate. Over 1,740 ft^2 of suitable trout spawning gravel deposits were noted in the low flow channel at this site during our survey. Overhanging vegetation was identified as the dominant cover type, though little overall cover was available at this site.

Site CL

This 318-foot long low-density riparian habitat site was located about 0.4 miles downstream of the MCWD's stream gage site at Old Mammoth Road (Figure 1). This site is near the upstream boundary of the Sherwin Creek Meadows section of Mammoth Creek. This site was located in a single channel area of the creek. During our survey, this site had a mean width of 20.1 feet and a mean depth of 0.79 feet and was composed of a combination of pool, run, and riffle habitats (Table 2). The site had a relatively low gradient (1.4 percent) and the substrate was composed primarily of cobble and boulder elements. About 296 ft^2 of suitable trout spawning gravel deposits were noted in the low flow channel at this site during our survey. Instream object cover (mainly boulder and large cobble) was identified as the dominant cover type. Signs of heavy angling pressure, in the form discarded lures and fishing line were evident at the time of the survey. This site is located in a stretch of creek that is regularly planted with catchable-sized rainbow trout from CDFG's Mt. Whitney and Fish Springs hatcheries.

Site CH

This 306-foot long high-density riparian cover habitat site was located in a relatively remote area of Mammoth Creek about 0.1 miles upstream of the Sherwin Creek confluence (Figure 1). This site was located within a single channel, full flow section of Mammoth Creek. During our survey, this site had a mean width of 13.0 feet and a mean depth of 0.88 feet and was predominantly run habitat (Table 2). The site had a relatively moderate gradient (3.1 percent) and the stream bed was dominated by cobble and boulder elements. Only about 80 ft^2 of suitable trout spawning gravel deposits were noted in the low flow channel at this site during our survey. Instream object (provided mainly by boulder and cobble bed elements) were identified as the dominant cover type.

Site DL

This 295-foot long low-density riparian habitat site was located in a relatively remote area of Mammoth Creek about 0.6 miles downstream of the Sherwin Creek confluence (Figure 1). While this area was a relatively low-density riparian section, it was located in a forested canyon area of the basin and carried the full stream flow of Mammoth Creek. During our survey, this site had a mean width of 16.3 feet and a mean depth of 0.75 feet and was a combination of pool, run, and riffle habitats (Table 2). Relatively large amounts of large woody debris (LWD) were present in this reach, contributed from the adjacent forested hillsides. The site had a relatively moderate gradient (2.9 percent) and the stream bed was dominated by cobble and boulder elements. While gravel was judged to be a significant portion of the substrate, it was distributed among the larger cobble substrate elements and most gravel was not judged available for trout spawning. Only 135 ft^2 of suitable trout spawning gravel deposits were noted in the low flow channel at this site during our survey. Instream object (boulder and cobble elements along with LWD) and undercut banks were identified as the dominant cover types.

Site DH

This 333-foot long high-density riparian cover habitat site was located about 0.30 miles upstream of the U.S. Highway 395 crossing (Figure 1). This site was located within a single channel area of Mammoth Creek. During our survey, this site had a mean width of 10.2 feet and a mean depth of 0.99 feet and was predominantly run habitat (Table 2). The gradient in this section of Mammoth Creek was relatively low, 0.6 percent. The stream bed in this reach was dominated by cobble and gravel substrates. About 656 ft^2 of suitable trout spawning gravel deposits were noted in the low flow channel at this site during our survey. Overhanging vegetation was identified as the dominant cover type.

Site EH

This 294-foot long high-density riparian habitat site was located downstream of the frontage road (Substation Road) crossing on the northeast side of U.S. Highway 395 (Figure 1). The upstream boundary of the study site was located about 25 feet downstream of the Los Angeles Department of Water and Power stream flow weir facility. During our survey, this site had a mean width of 17.4 feet and a mean depth of 0.69 feet and was composed predominantly of run habitat (Table 2). The gradient in this study section was relatively low (0.7 percent) and the stream bed was dominated by cobble and gravel substrates. About 379 ft^2 of suitable trout spawning gravel deposits were noted in the low flow channel at this site during our survey. Overhanging vegetation was identified as the dominant cover type. The abundance of discarded fishing tackle along the banks and upstream of the site suggests that this area receives substantial angling pressure. This site is located in an area that is regularly planted with catchable-sized rainbow trout by the California Department of Fish and Game. In fact, immediately following or survey, we noted almost twenty anglers fishing in a short section of stream located about 300 feet upstream of our survey site.

Site EL

This 308-foot long, single channel, low-density riparian cover habitat site was located in a meadow area of the creek just upstream of the Hot Creek confluence and adjacent to the Hot Creek State Fish Hatchery (Figure 1). The site is just downstream of extensive livestock grazing land (Chance Ranch). During our survey, this site had a mean width of 15.0 feet and a mean depth of 0.93 feet and was predominantly run habitat (Table 2). Undercut bank was identified as the dominant cover type, though overall, cover was not plentiful at this site. The site had a relatively low gradient (0.3 percent) and the stream bed was dominated by gravel substrate. About 1,727 ft^2 of suitable trout spawning gravel deposits were noted in the low flow channel at this site during our survey. This site also had the highest levels of fine sediment of any study reach. Rooted aquatic vegetation was present growing in the fine sediment areas in this reach. Examination of at least six different vegetation areas, as well as thorough searches through the abundant mats of vegetation that fouled the bottom block net following each electrofishing pass, failed to detect any NZMS that are reported to be present just downstream in Hot Creek.

Electrofishing

Copies of the electrofishing data sheets are contained in Appendix B. The October 2008 survey collected a total of 676 fish from five species (Table 3). Brown trout, which were captured at all eight sites, was the most abundant species at all eight sites and accounted for 79 percent of the overall total catch. Rainbow trout, captured at seven of the sample sites, was the second most abundant species in the total catch (18.5 percent). Of the 125 rainbow trout captured during the survey, 34 were identified as hatchery-reared fish.

Table 3. Numbers of fish captured at each of the electrofishing study sites, Mammoth Creek, Mono County, California, 8-11 October 2008.

Species	BH	BL	CH	CL	DH	DL	EH	EL	Total
Brown trout	196	32	61	29	55	14	88	59	534
Rainbow trout (wild)	34	0	4	1	6	19	9	18	91
Rainbow trout (hatchery)	0	0	3	7	9	1	13	1	34
Brook trout	1	0	0	0	0	0	0	0	1
Owens sucker	0	0	0	0	0	0	0	11	11
Tui chub	0	0	0	0	0	0	0	5	5
Total	231	32	68	37	70	34	110	94	676

No hatchery rainbow trout were identified at either of the two Reach B sites, both of which are upstream of the CDFG trout planting area. The greatest concentration of hatchery rainbow trout occurred at site EH. This site is regularly planted with hatchery fish by CDFG. The most contemporary release of hatchery rainbow trout in Mammoth Creek occurred on 2 October (six to nine days prior to our sampling) when 262 catchable-sized hatchery rainbow trout were released by Mount Whitney Hatchery personnel (Judy Urrutia, personal communication).

A single yearling brook trout (*Salvelinus fontinalis*) was captured at the upstream sample site (BH). The size of this fish suggests that it was naturally produced and probably originated from one of the lakes upstream of the project area.

A handful of young-of-the-year (YOY) Owens suckers and tui chub were captured at the most downstream site (EL) and made up 1.6 percent and 0.7 percent of the total catch, respectively.

Trout Length-frequency

Length-frequency analysis for rainbow trout captured at the various sites shows that multiple size (and presumably age) classes of wild rainbow trout are present at six of the eight study areas (Figure 3). The two exceptions were Reach BL, where no rainbow trout were captured, and Site CL, where only one wild rainbow trout was among the catch. In the previous two fall fish surveys, the YOY size class (fish <100 mm FL) dominated the wild rainbow trout populations at most of the study sites. In the 2008 survey, this smaller size (and age) class of trout made up the majority of wild rainbow trout populations at only three of the study sites (BH, DL, and EH). All of rainbow trout identified as hatchery trout were greater than 220 mm in length.

Examination of the brown trout length-frequencies shows multiple size/age classes present at all the sites (Figure 4). The YOY size class dominated the brown trout populations at the five of the eight survey sites. At the two Reach E sites, fish in the 120-200 mm size class dominated the brown trout populations. These size fish correspond to one year old trout that were part of the large cohort of YOY fish noted in these reaches during the October 2007 survey. At Site DL, where relatively few brown trout were captured, three size classes of brown trout, representing YOY, age 1 and age 2 fish exhibited near equal abundance in the catch.

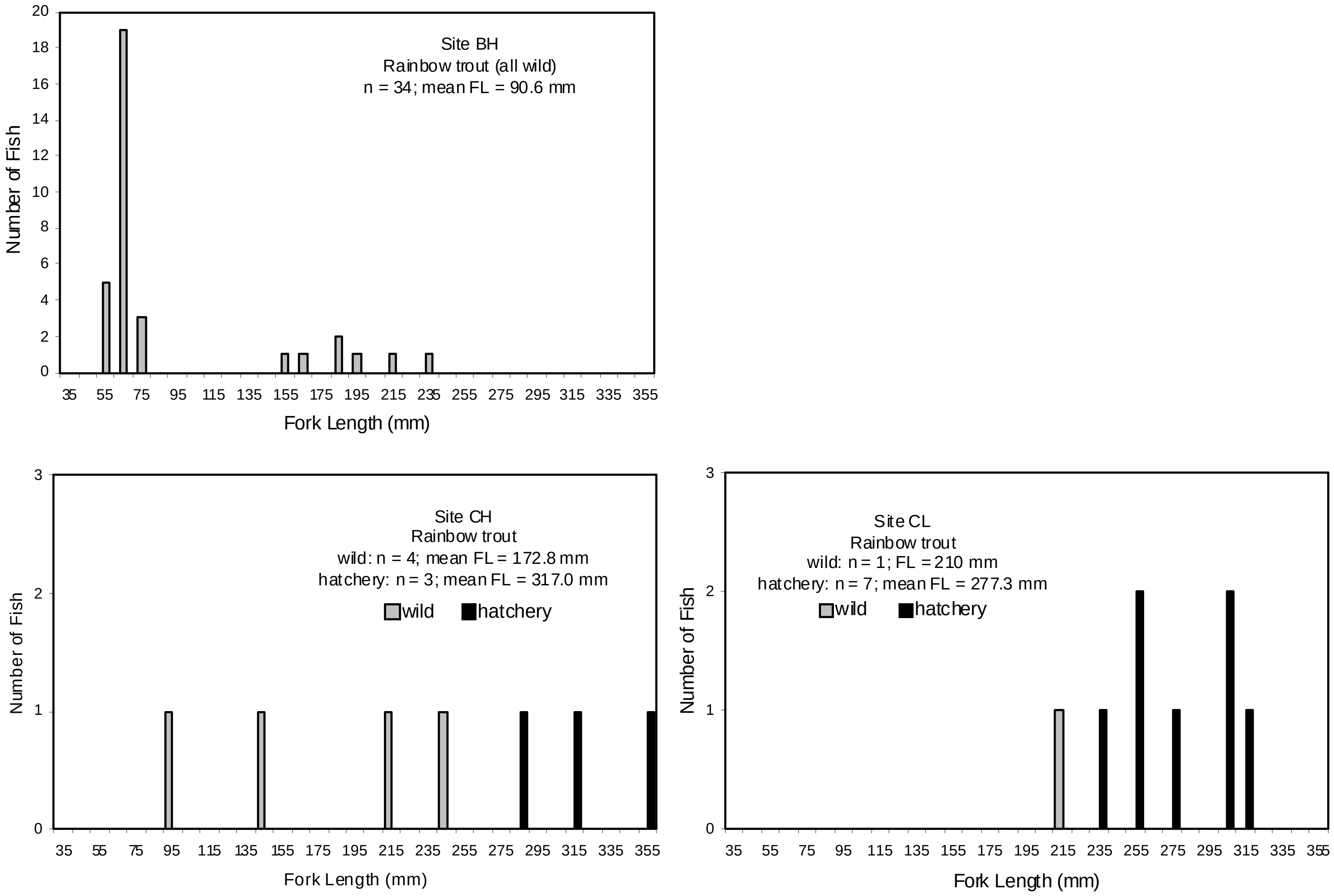


Figure 3. Length-frequency data for wild and hatchery rainbow trout captured during the October 2008 Mammoth Creek electrofishing survey.

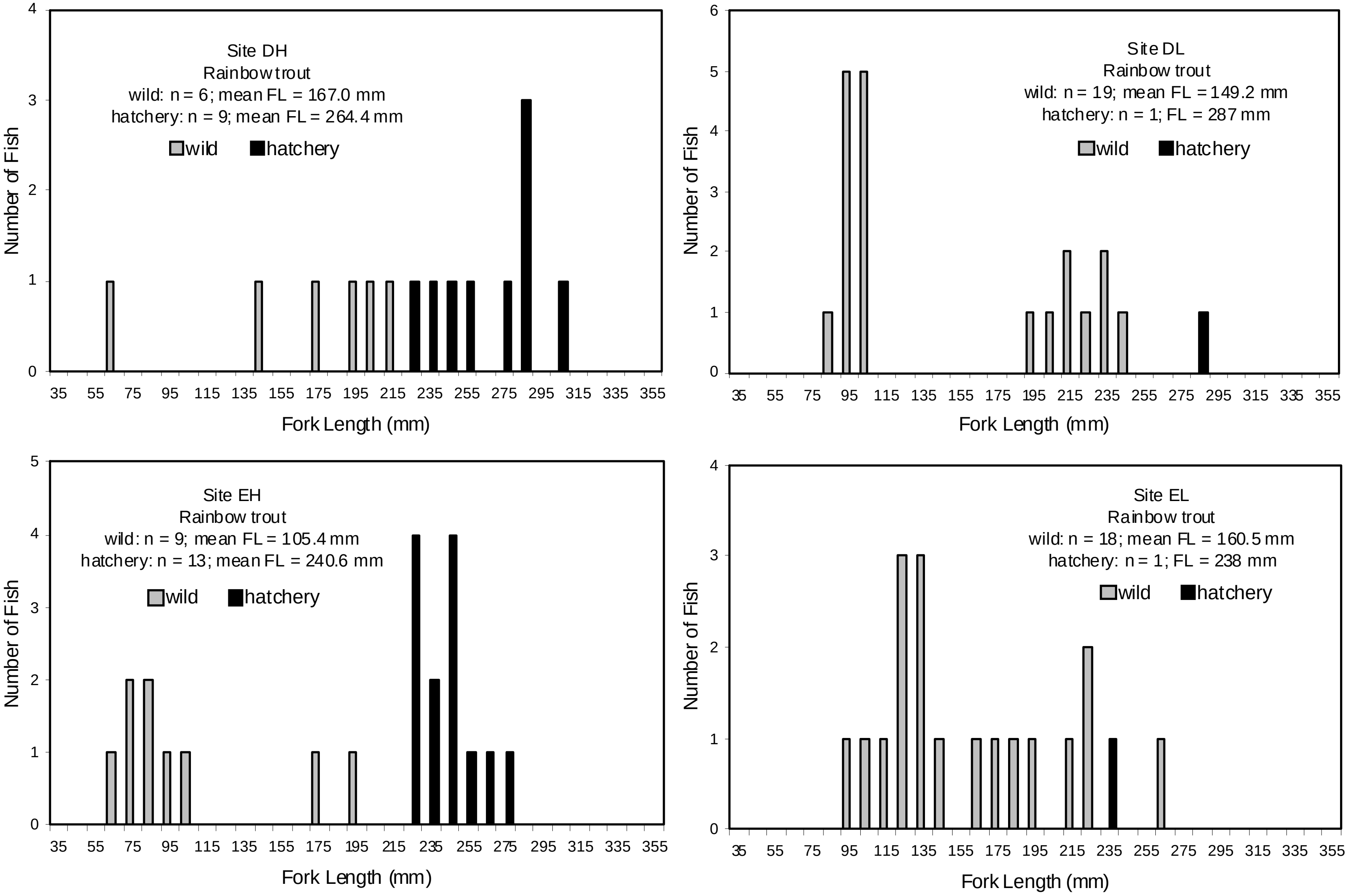


Figure 3. Length-frequency data for wild and hatchery rainbow trout captured during the October 2008 Mammoth Creek electrofishing survey. (continued)

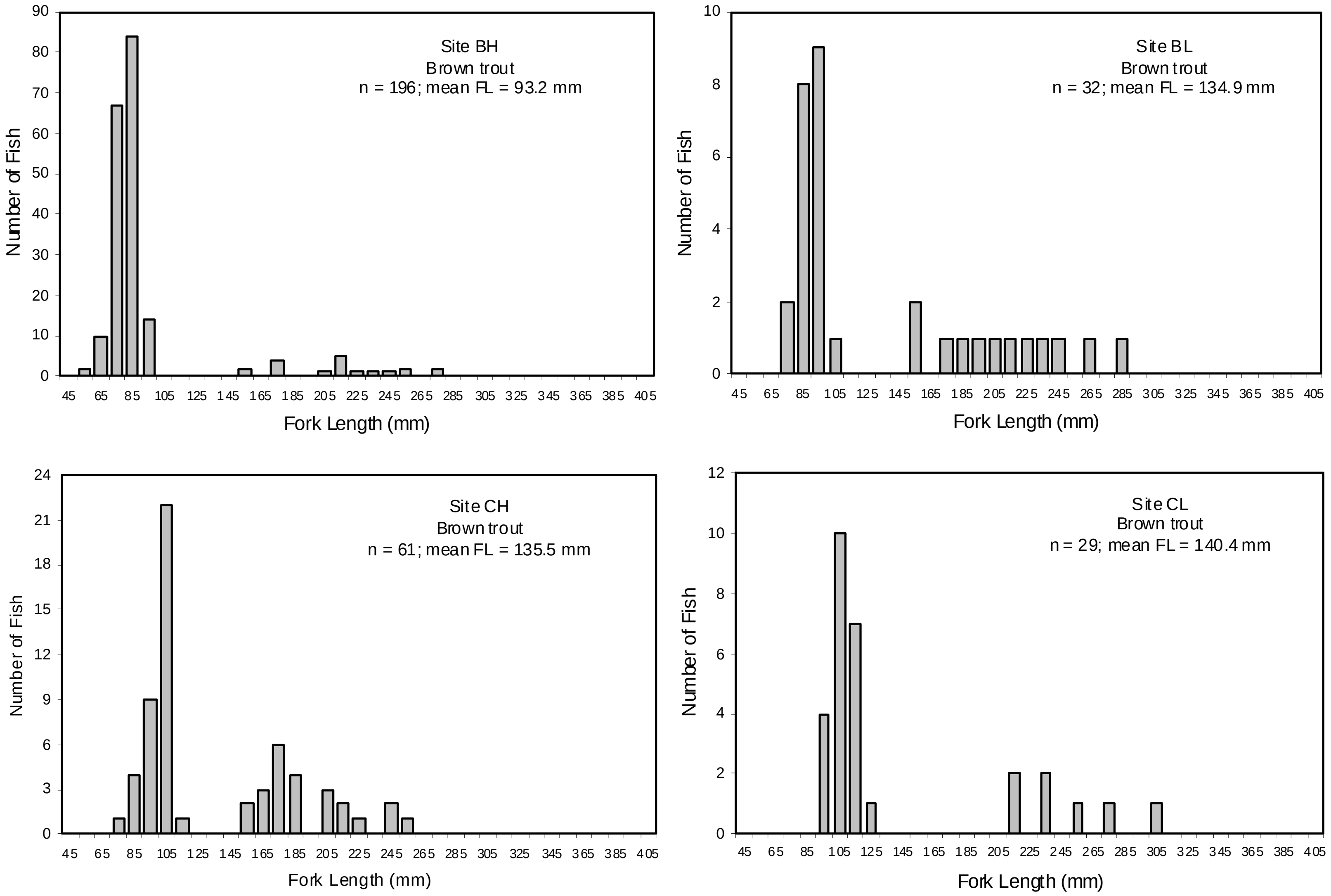


Figure 4. Length-frequency data for brown trout captured during the October 2008 Mammoth Creek electrofishing survey.

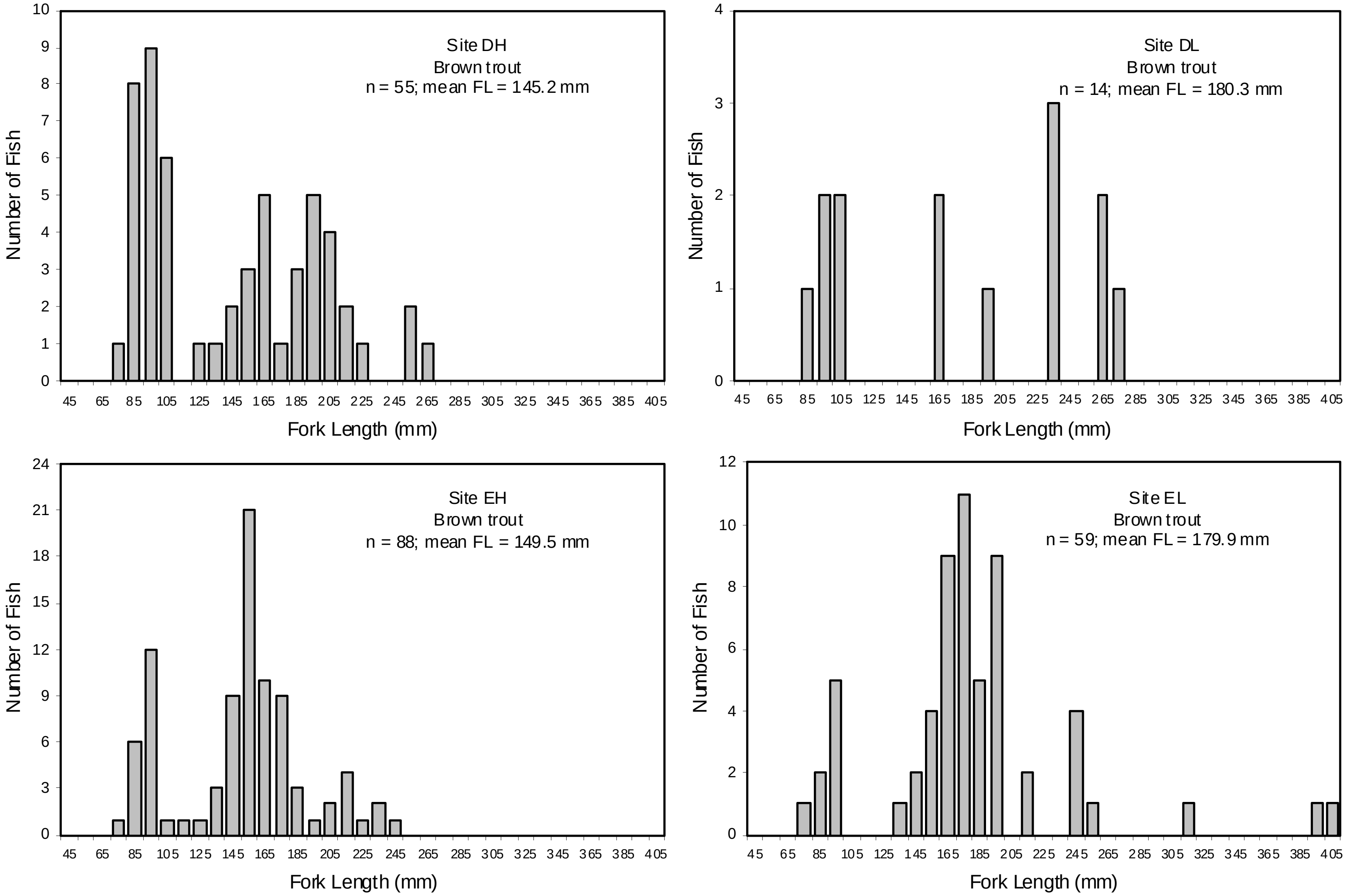


Figure 4. Length-frequency data for brown trout captured during the October 2008 Mammoth Creek electrofishing survey. (continued)

The numbers of YOY brown trout captured in 2008 (313 brown trout <120 mm FL) were less than 36 percent of the numbers captured in October 2007 (872 YOY brown trout), and nearly identical the numbers captured in 2006 (311 YOY brown trout). Based upon the large number of YOY brown trout noted throughout the Mammoth Creek project area in October 2007, we expected to see a corresponding spike in this strong year class of fish in October 2008, specifically as a large fraction of the trout populations by yearling brown trout in the 120 to 190 size classes. Large proportions of yearling trout were only noted at the two Reach E study sites (Figure 4).

The 2008 length data for the single brook trout captured at Site BH suggests that this was a yearling fish that likely moved downstream out of one upstream lakes where larger populations of this species is known to reside (Figure 5). The Owens suckers and tui chub captured at Site EL in October 2008 were all small, recently hatched YOY of the year fish. No adult suckers or minnows were observed or captured during the October 2008 survey.

Trout Condition Factors

The condition factor-frequency analysis suggests healthy populations of both rainbow and brown trout were present at all the study sites in October 2008, with mean condition factors all well above the 1.0 “healthy trout” threshold. Only 2.6 percent of the calculated condition factor values were less than this critical value. The mean condition factors for wild rainbow trout from the seven study sites where they were present ranged from 1.18 to 1.35, while those for hatchery rainbow trout ranged from 1.08 to 1.25 (Figure 6). The brown trout condition factors at the eight Mammoth Creek sites ranged from 1.13 to 1.21 (Figure 7).

Population Estimation

The MicroFish 3.0 (or CAPTURE) output, including the population estimates and associated statistics for each species at each site can be found in Appendix C. The model output is summarized below in Table 4.

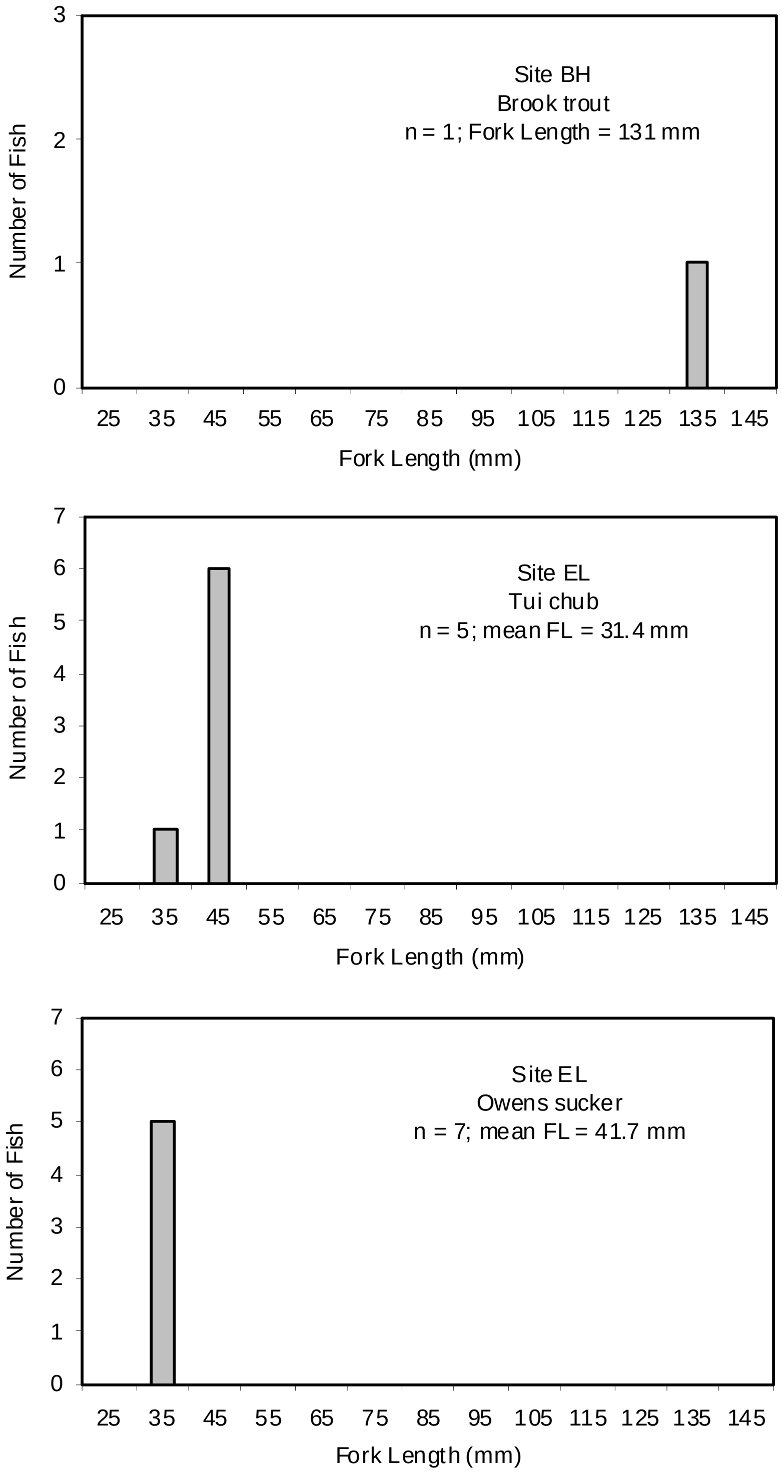


Figure 5. Length-frequency data for brook trout, Owens sucker, and tui chub captured during the October 2008 Mammoth Creek electrofishing survey.

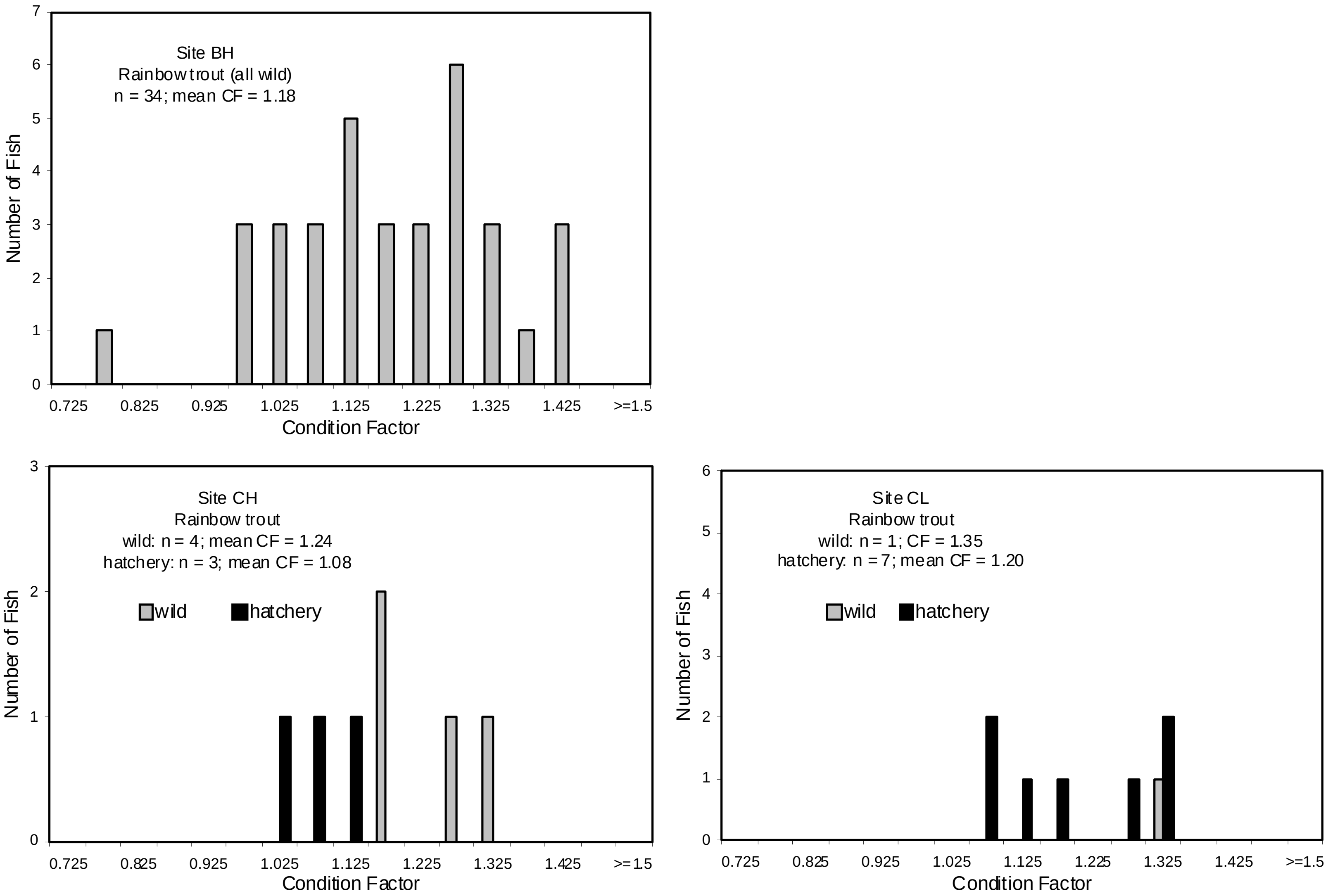


Figure 6. Condition factor-frequency data for wild and hatchery rainbow trout captured during the October 2008 Mammoth Creek electrofishing survey.

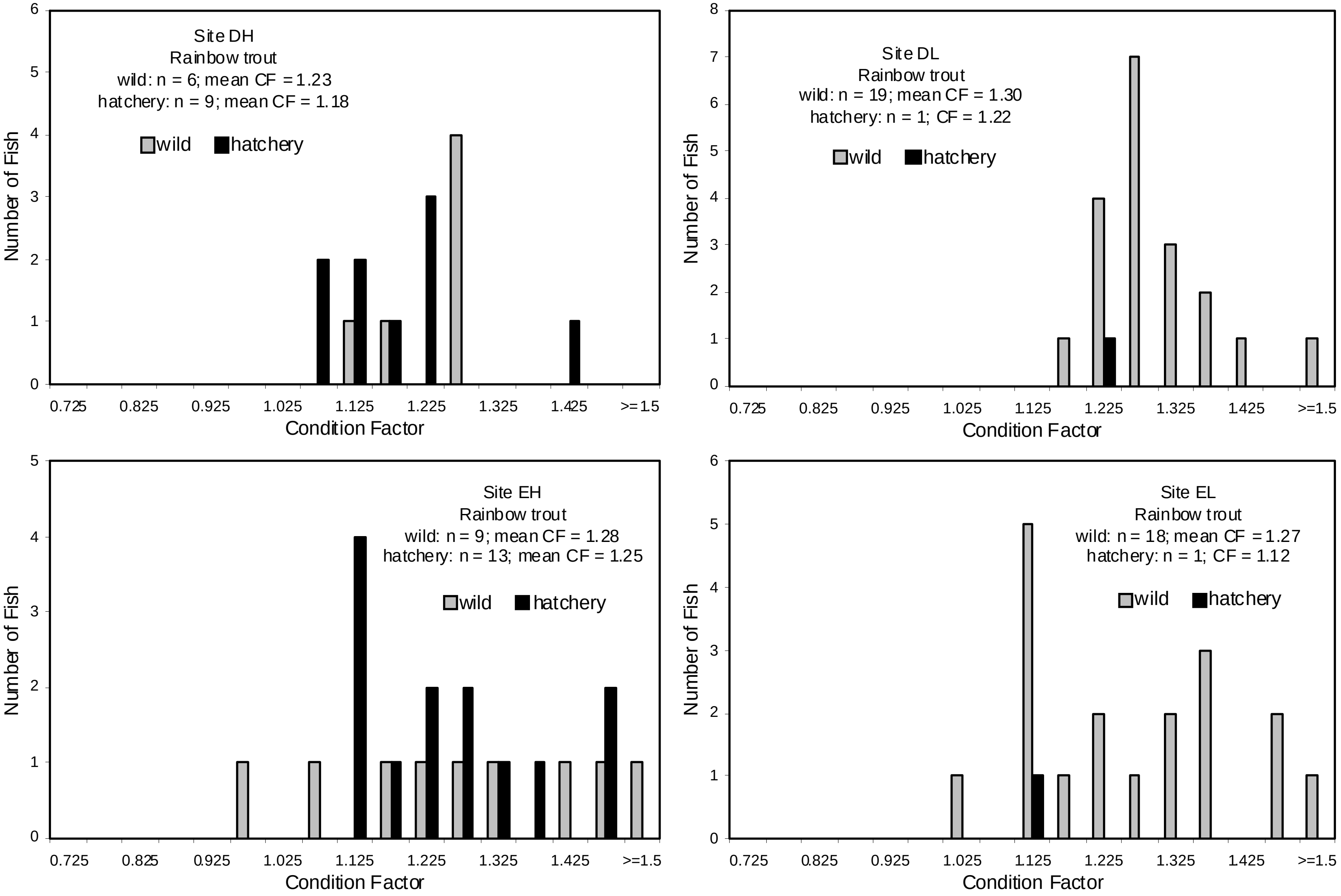


Figure 6. Condition factor-frequency data for wild and hatchery rainbow trout captured during the October 2008 Mammoth Creek electrofishing survey. (continued)

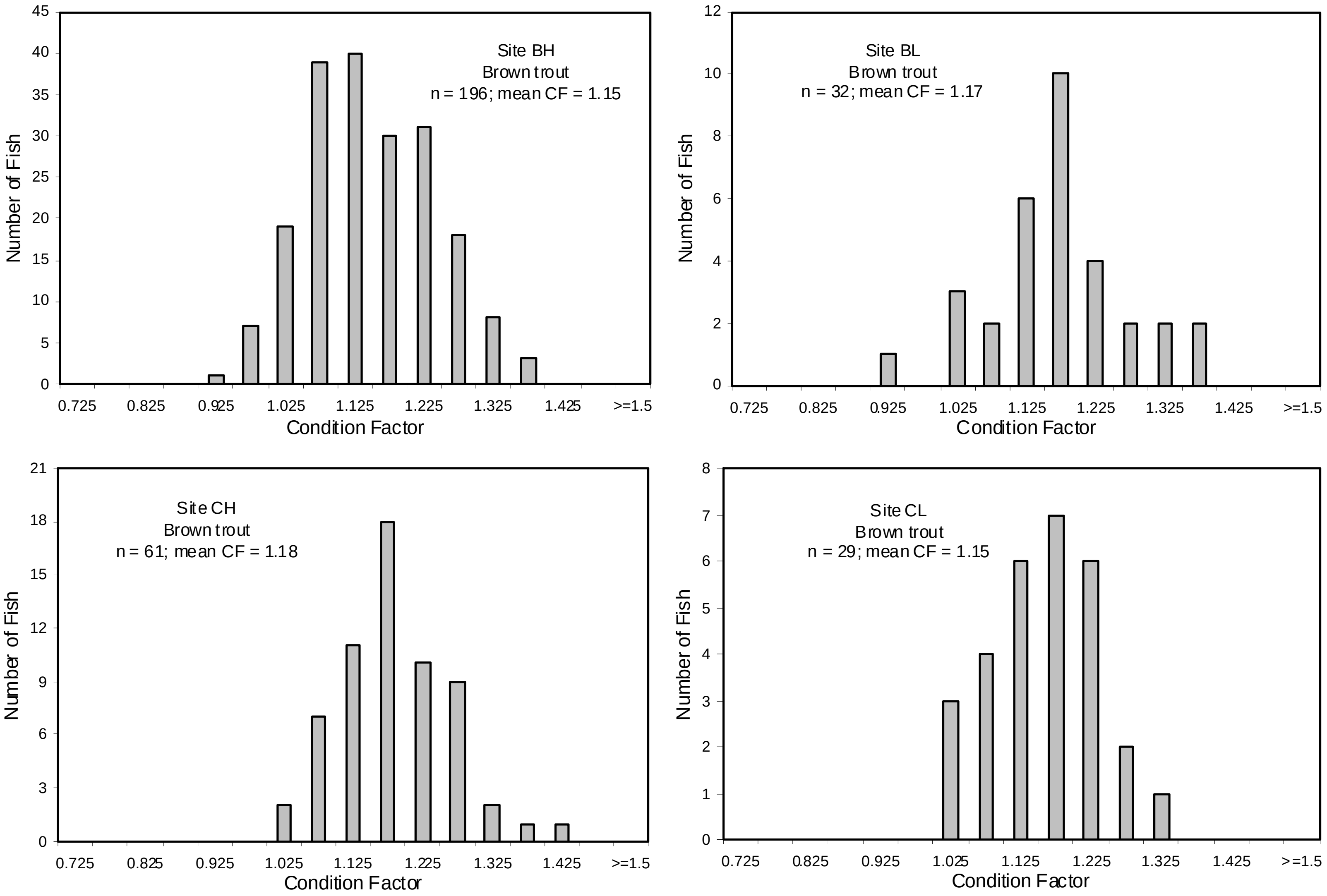


Figure 7. Condition factor-frequency data for brown trout captured during the October 2008 Mammoth Creek electrofishing survey.

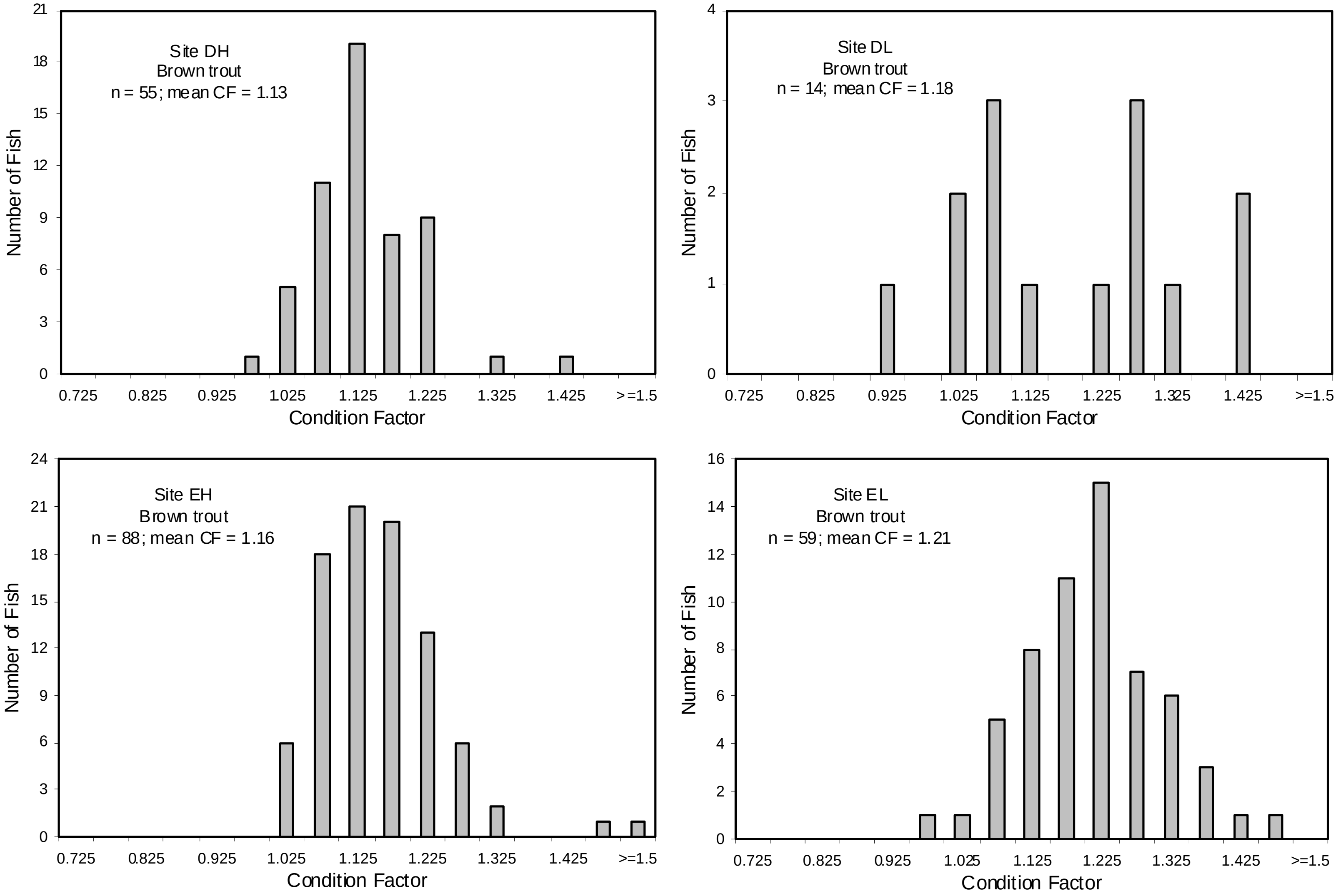


Figure 7. Condition factor-frequency data for brown trout captured during the October 2008 Mammoth Creek electrofishing survey. (continued)

The population estimates and their associated confidence intervals appear to be reasonably good for all the species at most sites (Table 4). Our sampling goal of obtaining a standard error of the population estimate for the dominant trout species that was ≤10 percent of the population estimate after three electrofishing passes was met at all eight electrofishing sites. Twenty-three of the twenty-four probabilities of capture surpassed the 0.4 "effective sampling" threshold (White et al. 1982). The one exception was for wild rainbow trout at Site EH when the largest proportion of the fish was captured on the second pass.

The estimated brown trout populations in the sampling sections during the October 2008 survey ranged from a low of 14 trout at Site DL to a high of 207 trout at Site BH (Table 4). The estimates for wild rainbow trout ranged from a low of zero fish at Site BL to a high of 40 fish at Site EH, though this last estimate is based upon an irregular three pass removal pattern. Hatchery rainbow trout population estimates ranged from zero fish at both Reach B Sites to a high of 13 hatchery trout at Site EH. Site EH is located in an area of Mammoth Creek that is regularly stocked by CDFG with hatchery rainbow trout.

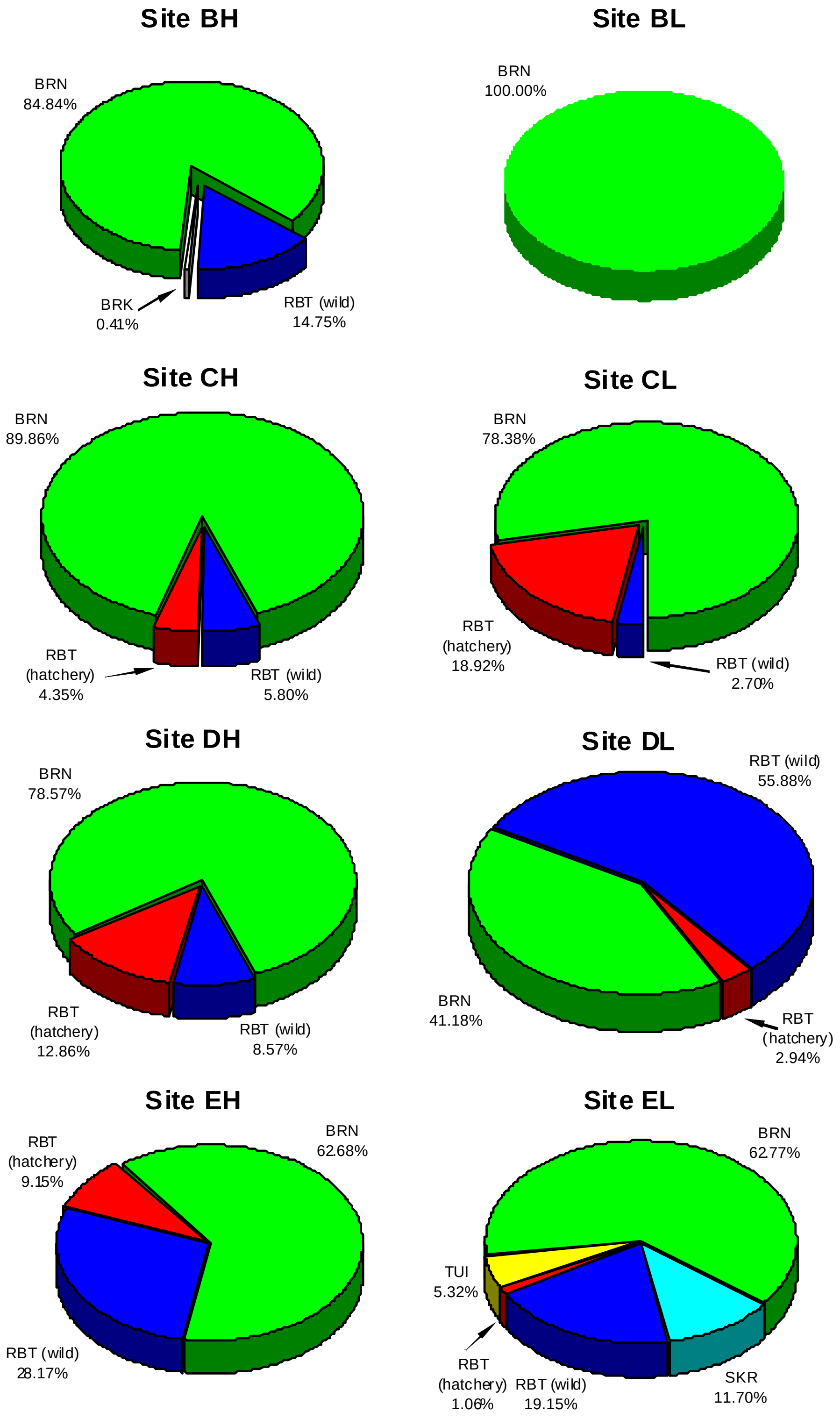
The calculated population estimates for each species were examined as the relative population abundance at each site (Figure 8). Brown trout dominated the fall 2008 fish populations at seven of the eight sample sites, contributing between 63 and 100 percent of the estimated number of fish. The survey data indicates that brown trout made up a larger proportion of the total fish populations at the high riparian density sites (mean contribution of 79.0 percent of the total populations) compared to the low riparian density sites (mean contribution of 70.6 percent).

In the October 2008 survey, wild rainbow trout typically made up less than 20 percent of the estimated fish populations at most of the Mammoth Creek survey sites (Figure 8). The two exceptions to this relatively minor contribution by wild rainbow trout were for Site DL, where wild rainbow trout made up almost 56 percent of the total population, and Site EH, where they made up over 28 percent. This calculated contribution of wild rainbow

Table 4. Multiple pass removal-depletion patterns and electrofishing statistics for various fish species captured at the eight Mammoth Creek sites, October 2008. Unless noted, all estimates were generated using the program MicroFish 3.0.

Species	Removal Pattern	Total Catch	Population Estimate	Standard Error	Probability of Capture Estimate
		Site BH			
Brown trout	131 – 42 – 23	196	207 ± 10	5.276	0.618 ± 0.082
Rainbow trout (wild)	20 – 10 – 4	34	36 ± 5	2.665	0.586 ± 0.213
Brook trout (wild)*	1 – 0 – 0	1	1 ± 1	0.000	0.9996
		Site BL			
Brown trout	27 – 3 – 2	32	32 ± 1	0.482	0.821 ± 0.140
		Site CH			
Brown trout	46 – 10 – 5	61	62 ± 3	1.437	0.726 ± 0.123
Rainbow trout (wild)*	4 – 0 – 0	4	4 ± 1	0.000	0.9999
Rainbow trout (hatchery)*	3 – 0 – 0	3	3 ± 1	0.000	0.9998
		Site CL			
Brown trout	20 – 7 – 2	29	29 ± 2	0.991	0.725 ± 0.185
Rainbow trout (wild)*	1 – 0 – 0	1	1 ± 1	0.000	0.9996
Rainbow trout (hatchery)	6 – 0 – 1	7	7 ± 1	0.327	0.778 ± 0.401
		Site DH			
Brown trout	48 – 4 – 3	55	55 ± 1	0.487	0.846 ± 0.098
Rainbow trout (wild)	5 – 1 - 0	6	6 ± 0	0.142	0.857 ± 0.366
Rainbow trout (hatchery)	7 – 1 - 1	9	9 ± 1	0.461	0.750 ± 0.354
		Site DL			
Brown trout	12 – 1 – 1	14	14 ± 1	0.309	0.824 ± 0.223
Rainbow trout (wild)	16 – 2 – 1	19	19 ± 1	0.352	0.826 ± 0.185
Rainbow trout (hatchery)*	1 – 0 – 0	1	1 ± 1	0.000	0.9996
		Site EH			
Brown trout	66 – 15– 7	88	89 ± 3	1.636	0.733 ± 0.100
Rainbow trout (wild)	1 – 6 – 2	9	40 ± 350	173.254	0.080 ± 0.766
Rainbow trout (hatchery)	11 – 2 – 0	13	13 ± 0	0.187	0.867 ± 0.205
		Site EL			
Brown trout	49– 8– 2	59	59 ± 1	0.591	0.831 ± 0.099
Rainbow trout (wild)	15 – 2 – 1	18	18 ± 1	0.369	0.818 ± 0.195
Rainbow trout (hatchery)*	1 – 0 – 0	1	1 ± 1	0.000	0.9996
Owens sucker	8 – 3 – 0	11	11 ± 1	0.384	0.786 ± 0.286
Tui chub	3 – 2 – 0	5	5 ± 1	0.444	0.714 ± 0.615

* Estimate derived using Program CAPTURE



Site BH

Site BL

Site CH

Site CL

Site DH

Site DL

Site EH

Site EL

Figure 8. Relative species abundance presented as percentage of total study reach population estimates for Mammoth Creek October 2008 electrofishing surveys.

trout at Site EH is likely an overestimate of the true relative abundance based upon the relatively high population estimate resulting from the poor removal-depletion pattern (Table 4). Wild rainbow trout wild tended to make up a slightly larger proportion of the fish populations at the low riparian density sites (19.4 percent) compared to the high riparian density sites (14.3 percent).

Hatchery rainbow trout were a minor component of the fish populations at the eight Mammoth Creek sites in the October 2008 survey. Site CL was the only location where hatchery rainbow trout contributed more than 15 percent of the fish population (18.9 percent at this location). As was previously mentioned, Site CL is located near one of the areas of the creek that is regularly stocked with hatchery rainbow trout. Hatchery rainbow trout make up nearly equally proportions of the fish populations in both the low riparian density sites (5.73 percent) and the high riparian density sites (6.59 percent).

The population estimates and reach lengths were used to extrapolate the population numbers to abundance estimates of fish per mile (Table 5). This extrapolation resulted in total trout (including all wild and hatchery fish) abundance estimates ranging from 552 to 4,183 trout per mile, with an average of 1,518 trout per mile. If only wild trout (both rainbow and brown) are considered, the abundance estimates for all sites average 1,446 wild trout per mile, and ranged from 499 wild trout per mile at Site CL to 4,183 fish per mile at Site BH.

Examination of the abundance index by species showed that brown trout estimates averaged 1,173 brown trout per mile, with range of 251 to 3,549 fish per mile (Table 5). Wild rainbow trout abundance estimates averaged 271 wild rainbow trout per mile and ranged from zero to 718 fish per mile. Hatchery rainbow abundance estimates averaged 72 hatchery fish per mile and ranged from zero to 233 fish per mile. The highest hatchery rainbow trout abundance estimate occurred at Site EH, just downstream of the Old Highway road crossing and an area regularly stocked with hatchery rainbow trout.

Table 5. Mean weights and standardized abundance and biomass estimates for various fish species captured at the eight Mammoth Creek electrofishing sites, October 2008.

Species	Mean wt (grams)	**Abundance Estimates**		**Biomass Estimates**	
		Fish/mile	Fish/acre	Pounds/mile	Pounds/acre
		Site BH			
Brown trout	16.52	3,549	2,268	129.23	82.59
Rainbow trout (wild)	21.11	617	394	28.72	18.35
Brook trout	23.30	17	11	0.88	0.56
Total		4,183	2,673	158.83	101.50
		Site BL			
Brown trout	50.43	552	520	61.38	57.85
		Site CH			
Brown trout	41.53	1,070	680	97.94	62.29
Rainbow trout (wild)	84.13	69	44	12.80	8.14
Rainbow trout (hatchery)	352.00	52	33	40.17	25.55
Total		1,191	757	150.91	95.98
		Site CL			
Brown trout	55.20	482	198	58.59	24.06
Rainbow trout (wild)	124.60	17	7	4.56	1.87
Rainbow trout (hatchery)	259.16	116	48	66.40	27.27
Total		615	253	129.55	53.20
		Site DH			
Brown trout	48.21	872	709	92.68	75.30
Rainbow trout (wild)	72.37	95	77	15.18	12.33
Rainbow trout (hatchery)	219.89	143	116	69.17	56.20
Total		1,110	902	177.03	143.83
		Site DL			
Brown trout	90.06	251	127	49.75	25.24
Rainbow trout (wild)	64.72	340	173	48.52	24.61
Rainbow trout (hatchery)	289.40	18	9	11.42	5.79
Total		609	309	109.69	55.64
		Site EH			
Brown trout	46.12	1,598	759	162.51	77.17
Rainbow trout (wild)	23.18	718	341	36.71	17.43
Rainbow trout (hatchery)	176.55	233	111	90.87	43.15
Total		2,549	1,211	290.09	137.75
		Site EL			
Brown trout	94.94	1,011	556	211.69	116.43
Rainbow trout (wild)	63.57	309	170	43.24	23.78
Rainbow trout (hatchery)	150.90	17	9	5.70	3.14
Owens sucker	0.83	189	104	0.35	0.19
Tui chub	0.40	86	47	0.08	0.04
Total trout		1,337	735	260.63	143.35
Total Fish		1,612	886	261.06	143.58

The total trout (including hatchery fish) abundance estimates in sites characterized by high-density riparian cover ranged from 1,110 trout per mile at Site DH up to 4,183 trout per mile at Site BH (Table 5). The low-density riparian cover population estimates for all trout ranged from 552 trout per mile at site BL to 1,337 trout per mile at Site EL. The average abundance for all trout at the high-density riparian cover sites was 2,258 trout per mile compared to an average of 778 trout per mile for the low-density riparian cover sites. If the comparison is limited to wild trout only (brown, brook, and wild rainbow), the discrepancy between the average abundances in the two different riparian areas is even greater. The average abundance for wild trout at the high-density riparian cover sites was 2,151 wild trout per mile compared to an average of 741 wild trout per mile for the low-density riparian cover sites. The 2008 data suggested that the density of wild trout was 2.9 times greater in the high-density riparian Mammoth Creek sites compared with the low-density sites. This differential is remarkably consistent with the results of the 2006 and 2007 surveys, where the density differential was 2.5 and 2.4 times, respectively, for the two different types of riparian habitats (Salamunovich 2006, 2007).

A similar trend was apparent for the hatchery fish, with higher densities of planted trout at the high-density riparian areas (Table 5). The average abundance for hatchery rainbow trout at the high-density riparian cover sites survey was 107 trout per mile compared to an average of 38 hatchery trout per mile for the low-density riparian sites. This pattern for higher abundances of hatchery trout at the high-density riparian sites is opposite of what has been observed during the past two years.

The calculated population estimates were also used in combination with the site-specific mean weights for each species to generate a relative population biomass at each site (Figure 9). In terms of biomass, brown trout dominated the fish populations at six of the eight sample sites, where this species contributed between 53 and 100 percent of the estimated total weight. At Site DL, both brown and wild rainbow trout contributed near equal proportions (about 45 percent each) to the total biomass. At Site CL, hatchery

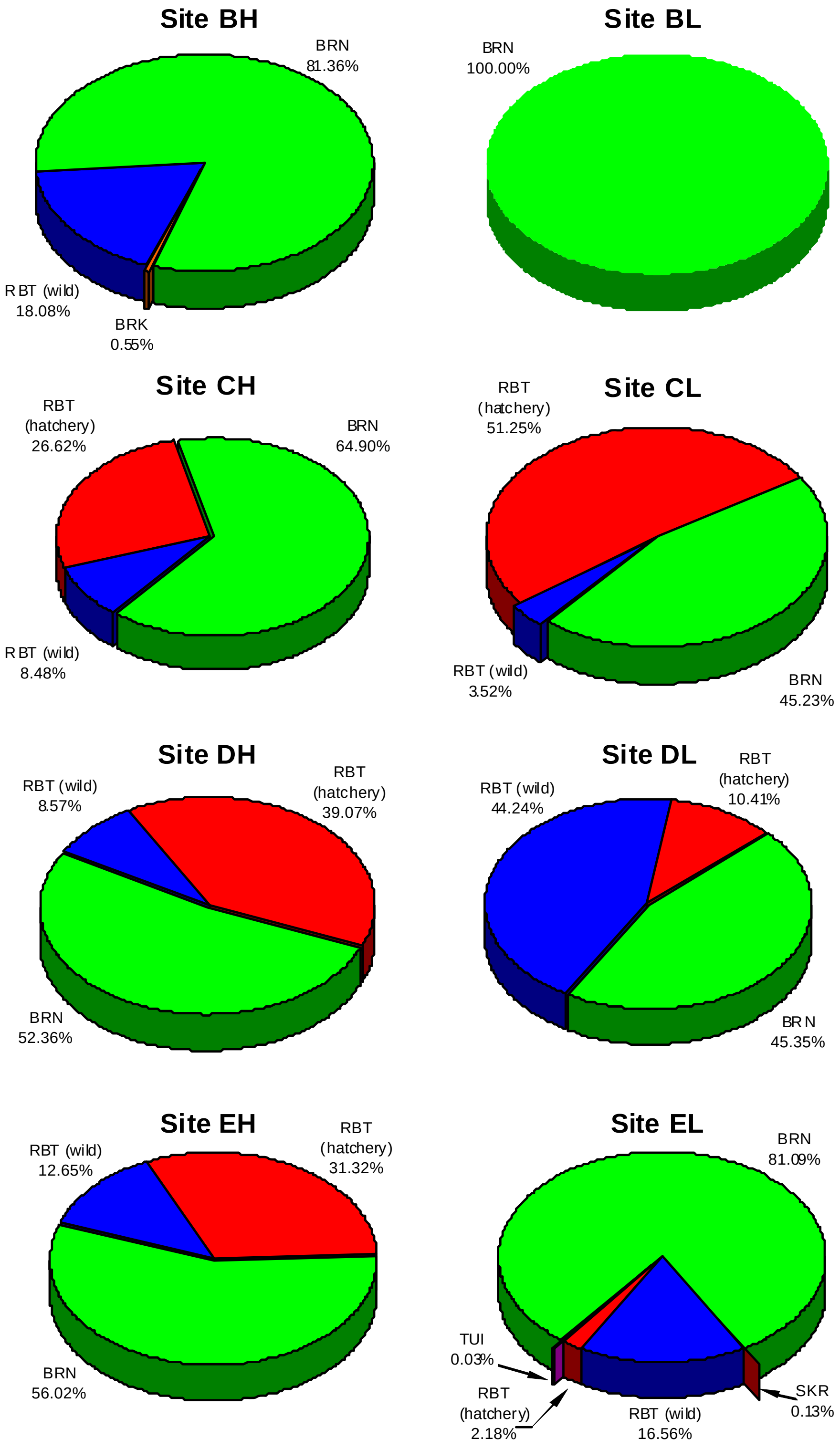


Figure 9. Relative species biomass presented as percentage of total study reach biomass estimates for Mammoth Creek October 2008 electrofishing surveys.

rainbow trout made up most of the estimated fish biomass compared to brown trout, 51 percent versus 45 percent, respectively. Site CL is located in an area that is regularly stocked with hatchery rainbow trout throughout the summer and early fall.

The reach biomass estimates were used to generate standardized biomass estimates of pounds per mile and pounds per acre that could be compared across sites and potentially across years (Table 5). The most commonly used biomass estimate, pounds of fish per acre, is the most representative, since it takes into account differences in sample areas at each of the Mammoth Creek sites. Total trout biomass estimates for all species combined, averaged 98.6 pounds per acre, and ranged from 53.2 pounds per acre at Site CL to 143.8 pounds per acre at Site DH. If only wild trout (rainbow, brook, and brown) are considered, the biomass estimates for all sites average 78.5 pounds of wild trout per acre, and ranged from 25.9 pounds per acre at Site CL to 140.2 pounds per acre at Site EL.

Examination of trout biomass by species showed that brown trout biomass estimates averaged 65.1 pounds per acre, with range of 24.1 to 116.4 pounds per acre (Table 5). Wild rainbow trout biomass estimates averaged 13.3 pounds per acre and ranged from zero to 24.6 pounds per acre. Hatchery rainbow biomass estimates averaged 20.1 pounds per acre and ranged from zero to 56.2 pounds per acre.

The total trout (including hatchery fish) biomass estimates at the four high-density riparian cover sites ranged from 96 pounds per acre at Site CH up to 143.8 pounds per acre at Site DH (Table 5). The low-density riparian cover biomass estimates for all trout ranged from53.2 pounds per acre at Site CL to 143.4 pounds per acre at Site EL. The average biomass estimate for all trout at the four high-density riparian cover sites was 119.8 pounds per acre compared to an average of 77.5 pounds per acre at the low-density riparian cover sites. If the comparison is limited to wild trout only (brown, brook, and wild rainbow), the discrepancy between the average biomass estimates in the two different riparian cover areas is not as great. The average biomass for wild trout at the high-density riparian cover sites was 88.5 pounds of wild trout per acre compared to an average of 68.5 pounds per acre for the low-density riparian cover sites. The 2008 data suggested that the biomass of wild trout was 1.3 times greater in the high-density riparian Mammoth Creek sites compared with the low-density sites. This 2008 ratio of average wild trout biomass in high-density versus low-density riparian areas is slightly lower than that noted in 2007 (ratio of 1.8), and almost identical to that observed in 2006 (ratio of 1.4; Salamunovich 2006, 2007).

A similar trend was apparent for the hatchery fish, with a higher average biomass of planted trout at the high-density riparian areas (Table 5). The average biomass for hatchery rainbow trout at the high-density riparian cover sites survey was 31.2 pounds per acre compared to an average of 9.1 pounds per acre of hatchery trout per mile at the four low-density riparian sites. This pattern for higher biomass of hatchery trout at the high-density riparian sites is opposite of what has been observed the previous two years.

Discussion

The October 2008 fish population sampling in Mammoth Creek demonstrated that multiple-pass removal-depletion sampling using electrofishing techniques can produce resident fish population estimates with tight confidence intervals and a high probability of accuracy.

The electrofishing survey showed the fall 2008 resident fish population in the project area was dominated by brown trout, which made up the largest fraction of the abundance estimates (fish per mile) at seven of the eight sample sites, and the largest fraction of the biomass estimates (pounds per acre) at six of the eight sample sites. Wild rainbow trout, while found at seven of the eight sites, were only a minor component of the fish populations either numerically or gravimetrically (biomass) at six of those sites. Only at Site DL did wild rainbow contribute substantially to either the standing crop or biomass of the resident trout populations in Mammoth Creek. The results of the October 2008 survey also suggested higher densities and biomass of both wild trout and hatchery trout were associated with the high-density riparian cover habitats.

In October 2008, native fish (suckers and chubs) were found at only the most downstream sample site. Due to their low numbers and small size, native fish contributed little to the overall fish population abundance or biomass indices. Suckers and chubs have only been present in relatively high numbers in the Mammoth Creek surveys in one year (2004) out of the past ten years of record (Table 6).

Table 6. Numbers of Owens sucker and tui chub captured during electrofishing surveys in the lower Mammoth Creek (Reaches EH & EL combined). Note that no survey was conducted in 1998.

Year	Owens sucker	Tui chub
1992	205	417
1993	425	855
1994	524	392
1995	58	69
1996	84	48
1997	2	2
1999	49	6
2000	18	2
2001	6	2
2002	2	2
2003	54	19
2004	122	30
2005	18	2
2006	11	6
2007	42	1
2008	11	5

The relatively high numbers of native fish noted in lower Mammoth Creek in the early 1990’s may have been due to lower stream flows and higher water temperatures that prevailed in the basin during the extended six-year long drought (1987-1992) immediately prior to those surveys (Table 6). Moyle et al. (1996) state that with a few exceptions, native non-game fishes in the Owens River basin do not generally occur in streams above

4,900 feet elevation. If this is true, the native fishes in lower Mammoth Creek (elevation 7,100-7,200 feet) are probably near the limits of their physical range and are able to expand their populations into higher elevation areas during those periods when stream flows remain low for extended periods of time. Their population expansion may also be a response to reduced predation pressure from resident trout during these drought periods.

The October 2008 length frequency data demonstrated the presence of multiple size/age classes of both brown trout and wild rainbow trout at most of the survey sites. The presence of young-of-the-year brown and wild rainbow trout at the survey sites demonstrated that both these species had successful reproduction during 2008. The large numbers of YOY brown trout at most sites suggests that stream flow and habitat conditions conducive for the reproduction and first year survival of this species were present throughout the Mammoth Creek basin during the 2008 water year. The condition factors for both wild rainbow trout and brown trout at all the sample areas were all well above the 1.0 “healthy” trout threshold. The combination of successful reproduction, presence of multiple size/age classes, and high condition factors, suggest that the resident trout fishery in Mammoth Creek are healthy and continue to be maintained in good condition.

A comparison of the standardized abundance estimates (i.e. number of trout per mile) for the October 2008 survey with values from previous surveys showed a decrease in brown trout abundance over the 2007 levels in seven of the eight study sites, as well as the yearly mean (Table 7). The brown trout abundances estimates for the October 2008 surveys were considerably less than sixteen year average in five of the eight study sites. Only three study reaches had abundance estimates at or above the sixteen year average (Reaches CL, CH, and EL). The average 2008 brown trout abundance for all eight sites was about 78 percent of the sixteen year average. This 2008 average ranked as the fourth lowest brown trout abundance among the sixteen annual surveys conducted since 1992. Only the 1995, 2005 and 2006 average abundances were lower than the 2008 yearly mean.

Table 7. Standardized abundance estimates (trout/mile) for brown trout captured at the eight Mammoth Creek electrofishing sites, 1992-2008. Bold numbers indicate the highest value for each site. Numbers in parenthesis indicate where the 2008 survey results ranked among the sixteen surveys. Note that no survey was conducted in 1998.

	Sample Site								
	BH	BL	CH	CL	DH	DL	EH	EL	Yrly Mean
2008	3,549 (9th)	552 (10th)	1,070 (9th)	482 (7th)	872 (10th)	251 (15th)	1,598 (7th)	1,011 (8th)	1,173 (13th)
2007	4,949	238	1,691	731	3,142	**1,766**	**4,302**	**2,900**	**2,465**
2006	3,241	313	475	290	1,155	287	1,297	1,411	1,059
2005	1,320	792	634	194	387	862	704	563	682
2004	3,186	440	1,302	845	880	1,549	1,355	581	1,267
2003	2,869	458	**1,901**	933	616	1,426	1,390	616	1,276
2002	5,826	898	1,056	246	563	1,672	1,866	264	1,549
2001	4,717	1,707	1,496	246	1,144	1,162	1,461	528	1,558
2000	6,670	634	1,074	88	810	1,162	1,179	2,253	1,734
1999	5,333	1,338	1,443	299	2,200	616	2,182	2,200	1,951
1997	**8,589**	704	1,690	211	616	1,654	3,819	1,795	2,385
1996	4,840	158	1,302	158	1,901	634	898	1,144	1,379
1995	1,760	546	334	88	616	18	334	1,038	592
1994	4,171	2,253	810	528	**4,418**	1,584	2,464	405	2,079
1993	2,957	**2,658**	510	**1,232**	1,056	510	1,232	158	1,289
1992	3,042	1,848	563	845	1,390	1,584	3,978	194	1,681
mean	4,189	971	1,084	463	1,360	1,046	1,879	1,066	1,507

The 2008 Mammoth Creek abundance estimates for wild rainbow trout were lower than those from 2007 at six of the eight study sites (Table 8). The 2008 wild rainbow trout abundance estimates were below the sixteen year average at five of the eight study sites. Despite this general site-by-site decrease over 2007 levels, the yearly mean abundance of wild rainbow trout for the October 2008 and October 2007 surveys were almost identical. The 2008 yearly mean average of wild rainbow trout for all eight sites was about 69 percent of the sixteen year average. This 2008 average ranked as the seventh lowest wild rainbow trout abundance among the sixteen annual surveys conducted since 1992.

Table 8. Standardized abundance estimates (trout/mile) for wild rainbow trout captured at the eight Mammoth Creek electrofishing sites, 1992-2008. Bold numbers indicate the highest value for each site. Numbers in parenthesis indicate where the 2008 survey results ranked among the sixteen surveys. Note that no survey was conducted in 1998.

	Sample Site								
	BH	BL	CH	CL	DH	DL	EH	EL	Yrly Mean
2008	617 (5th)	0 (12th [a])	69 (15th)	17 (14th)	95 (15th)	340 (9th)	718 (4th)	309 (4th)	271 (10th)
2007	680	55	121	83	421	428	222	168	272
2006	819	110	282	239	413	359	902	366	436
2005	493	282	70	0	158	158	141	475[b]	222
2004	422	246	123	35	229	246	88	18	176
2003	669	194	106	35	211	282	158	0	207
2002	**1,039**	**810**	123	123	528	475	229	18	418
2001	616	106	88	722	563	422	493	18	379
2000	35	616	405	**6,354**	528	669	**2,253**	158	**1,377**
1999	123	669	546	1,179	686	510	334	194	530
1997	123	123	810	933	722	**1,021**	810	88	579
1996	282	18	**1,690**	528	**933**	229	458	**563**	588
1995	158	0	53	59	18	88	53	194	78
1994	35	0	581	1,654	387	616	106	0	422
1993	18	0	70	0	299	35	53	18	62
1992	70	0	141	651	546	229	141	0	222
mean	387	202	330	788	421	382	447	162	390

[a] tied with five years

[b] hatchery and wild trout not differentiated at this site; all trout assumed to be wild fish

Fewer hatchery rainbow trout were captured in the 2008 surveys compared to the previous two October surveys (Table 9). Stocked fish tend to have higher angler catch rates and poorer survival compared to wild rainbow trout. The relatively low numbers of hatchery rainbow trout in both the 2007 and 2008 surveys may have been an artifact of the timing of the planting schedules. In 2006, when more hatchery rainbow trout were captured, trout had been planted in Mammoth Creek five days prior to the surveys and again during the surveys. In both 2007 and 2008, when fewer hatchery rainbow trout were captured, trout had been planted in Mammoth Creek six to eight days prior to our surveys.

Table 9. Numbers of hatchery rainbow trout captured, dates of the most proximal trout plantings, and the surveys dates for the 2006 through 2008 Mammoth Creek fish surveys.

Year	Number	Trout Planting Dates	Survey Dates
2006	77	6 October & 12 October	11 - 15 October
2007	45	2 October	10 - 14 October
2008	34	2 October	8 - 11 October

Additional support for categorizing the Mammoth Creek wild trout fishery as in good condition can be derived from a comparison of the October 2008 biomass estimates in Table 5 to those from Gerstung (1973) shown in Table 10.

Table 10. Relationship between stream width and trout biomass in California waters (Gerstung 1973).

Average Stream Width (feet)	Trout Biomass (pounds per acre)
2 – 5	76
6 – 10	70
11 – 15	35
16 – 25	33
26 – 40	24
41 – 70	13

The stream widths of seven of the eight Mammoth Creek sites are in the 11 to 20 foot ranges (Table 2). These seven sites had an average wild trout (both brown and rainbow) biomass estimate of 81.5 pounds per acre, and ranged from a low of 25.9 (Site CL) to a high of 140.2 pounds per acre (Site EL). The 2008 biomass estimates at six of these seven "wider" Mammoth Creek sites are all well in excess of the 33 to 35 pounds per acre reported by Gerstung (1973) for similarly sized California trout streams. Site BL, with a mean width of 8.8 feet, had a wild trout biomass estimate of 57.9 pounds per acre, which is 83 percent of Gerstung's (1973) biomass threshold for this sized stream. Despite the "lower than average" biomass at Sites BL and CL, the body of evidence from the October 2008 survey data continues to suggest that the Mammoth Creek basin trout populations are generally at levels exceeding recommended levels and that they are continuing to be maintained in good condition.

Prior to 2006, width measurements at the Mammoth Creek sites were not recorded (or at least not reported). In addition, weights for many of the larger trout were not recorded, making meaningful and accurate weight estimates impossible. The lack of this information prevents any back calculation of density and biomass estimates from the earlier MCWD sponsored surveys.

The 2008 density and biomass estimates were compared to those from the 2006 and 2007 surveys and from comparable values available in the literature (Table 11). The literature sources included CDFG electrofishing population surveys conducted throughout the Owens River basin (including Mammoth Creek) in the early 1980's (Deinstadt et al. 1985, 1986). The U.S. Forest Service (USFS) conducted an analysis of trout populations throughout the western United States and reported density and biomass data for Mammoth Creek as well as for numerous streams and rivers throughout the Sierra Nevada Ecoregion (Platts and McHenry 1988).

The average 2008 Mammoth Creek abundance and density estimates for either the all trout or wild trout only categories appear to be about average for comparable estimates recorded for the Mammoth basin for previous surveys (Table 11). The 2008 biomass estimates are below average for the available Mammoth Creek values. The relatively large proportion of smaller YOY brown trout in the 2008 Mammoth Creek populations contributed to moderating the biomass estimates. The 2008 Mammoth Creek estimates are slightly below levels expected for the Owens River basin based upon previous surveys, but still exceed the average density and biomass estimates for the Sierra Nevada region. These comparisons suggest that the current trout populations in Mammoth Creek remain in good condition compared to historical basin or regional standards.

Table 11. Average abundance, density and biomass estimates for trout in Mammoth Creek, the Owens River Basin, and the Sierra Nevada Forest Ecoregion derived from recent Mammoth Community Water District surveys and other literature sources.

		Abundance (trout/mile)	Density (trout/m^2)	Biomass (grams trout/m^2)
Mammoth Creek				
2008 MCWD surveys (8 sites) [1/]	all trout	1,518	0.23	11.1
	wild trout only	1,446	0.22	8.8
2007 MCWD surveys (8 sites) [2/]	all trout	2,832	0.41	13.9
	wild trout only	2,737	0.39	10.4
2006 MCWD surveys (8 sites) [3/]	all trout	1,666	0.23	13.5
	wild trout only	1,497	0.21	10.1
1988 USFS analysis [4/]		---	0.23	18.0
1985 CDFG surveys (5 sites below Lake Mary) [5/]		2,244	0.37	13.3
1984 CDFG surveys (2 sites) [6/]		1,490	0.16	25.0
1983 CDFG surveys (3 sites) [6/]		1,531	0.16	13.6
Owens River Basin				
1985 CDFG surveys (43 sites) [5/]		2,530	0.35	13.9
1984 CDFG surveys (24 sites) [6/]		2,336	0.30	19.9
1983 CDFG surveys (45 sites) [5/ & 6/]		1,362	0.27	13.2
1982 CDFG surveys (2 sites) [6/]		1,940	0.40	6.4
1981 CDFG surveys (4 sites) [6/]		1,334	0.20	12.4
1980 CDFG surveys (12 sites) [5/ & 6/]		2,184	0.11	14.6
Sierra Nevada Ecoregion				
streams w/brown/rainbow trout populations (24 sites) [4/]		---	0.13	8.5
all streams (53 sites) [4/]		---	0.16	9.0

[1/] this report [2/] Salamunovich 2007 [3/] Salamunovich 2006 [4/] Platts and McHenry 1988 (includes hatchery trout) [5/] Deinstadt et al. 1986 (includes hatchery trout) [6/] Deinstadt et al. 1985 (includes hatchery trout)

The fifteen year record of abundance data suggests that the trout populations in Mammoth Creek exhibit wide variations both between years and even between sites within years. These annual variations are probably controlled by a wide variety of environmental and biological variables including stream flows, water temperatures, habitat availability, food availability, reproductive success, year class strength, recruitment, overwinter survival, hatchery stocking practices, and angling pressure. Despite the spatial and temporal variations in trout abundance, evident in the long term Mammoth Creek fish survey data, the wild trout populations in the basin still appear to be in good physical condition.

Literature Cited

Bagenal, T.B., and F.W. Tesch. 1978. Age and growth. Chapter 5 *in* T.B. Bagenal, editor. Methods for assessment of fish production in fresh waters, 3rd edition. International Biological Programme Handbook 3. Blackwell Scientific Publications. Oxford. 365p.

Bratovich, P.M., K.L. Carlson, D.B. Christophel, and T.A. Jackson. 1992. Expert Testimony on Mammoth Creek Instream Flow Issues. Prepared by Beak Consultants for the California State Water Resources Control Board Water Rights Hearing on Mammoth Creek, March 10, 1992.

Bratovich, P.M., K.L. Carlson, D.B. Christophel, and T.A. Jackson. 1990. Mammoth Creek Instream Flow Investigations. Prepared by Beak Consultants for the Mammoth County Water District, Mammoth Lakes, California.

California Department of Water Resources. 1973. Mammoth basin water resources environmental study. December 1973 final report.

Chen, Y., S. Parmenter, and B. May. 2006. Introgression between Lahontan and endangered Owens tui chubs, and apparent discovery of a new tui chub in the Owens Valley, California. Online publication in Conservation Genetics, Volume 7.

CH2M Hill. 2000. Environmental Impact Report/ Environmental Impact Statement – Changes in Mammoth Creek Instream Flow Requirements, Change of Point of Measurement, and Change of Place of Use. Prepared for: Mammoth Community Water District and United States Forest Service.

Everhart, H.W., A.W. Eipper, and W.D. Youngs. 1975. Principles of fishery science. Cornell University Press, Ithaca, NY. 288p.

Deinstadt, J.M., D.R. McEwan, and D.M. Wong. 1985. Survey of fish populations in streams of the Owens River drainage: 1983-84. California Department of Fish and Game, Inland Fisheries Administrative Report 85-2. 102 pp.

Deinstadt, J.M., G.F. Sibbald, J.D. Knarr, and D.M. Wong. 1986. Survey of fish populations in streams of the Owens River drainage: 1985. California Department of Fish and Game, Inland Fisheries Administrative Report 86-3. 71 pp.

Gerstung, E.R. 1973. Fish population and yield estimates from California trout streams. Cal-Neva Wildlife 1973:9-19.

Hosea, R.C., and B. Finlayson. 2005. Controlling the spread of New Zealand mud snails on wading gear. California Department of Fish and Game, Office of Spill Prevention and Response Administrative Report 2005-02. 38pp.

Hood, D.J. 1998. Mammoth Creek 1997 Fish Community Survey. Prepared by KDH Biological Consultants for the Mammoth Community Water District, Mammoth Lakes, California.

Hood, D.J. 2001. Mammoth Creek 2000 Fish Community Survey. Prepared by KDH Biological Consultants for the Mammoth Community Water District, Mammoth Lakes, California.

Hood, D.J. 2002. Mammoth Creek 2001 Fish Community Survey. Prepared by KDH Biological Consultants for the Mammoth Community Water District, Mammoth Lakes, California.

Hood, D.J. 2003. Mammoth Creek 2002 Fish Community Survey. Prepared by KDH Biological Consultants for the Mammoth Community Water District, Mammoth Lakes, California.

Hood, D.J. 2004. Mammoth Creek 2003 Fish Community Survey. Prepared by KDH Biological Consultants for the Mammoth Community Water District, Mammoth Lakes, California.

Hood, D.J. 2006a. Mammoth Creek 2004 Fish Community Survey. Prepared by KDH Biological Consultants for the Mammoth Community Water District, Mammoth Lakes, California.

Hood, D.J. 2006b. Mammoth Creek 2005 Fish Community Survey. Draft report prepared by KDH Biological Consultants for the Mammoth Community Water District, Mammoth Lakes, California.

Hood, D.J., P.M. Bratovich, and D.B. Christophel. 1993. Mammoth Creek 1993 Fish Community Survey. Prepared by Beak Consultants for the Mammoth County Water District, Mammoth Lakes, California.

Hood, D.J., P.M. Bratovich, and D.B. Christophel. 1994. Mammoth Creek 1994 Fish Community Survey. Prepared by Beak Consultants for the Mammoth County Water District, Mammoth Lakes, California.

Hood, D.J., D.B. Christophel, and P.M. Bratovich. 1992. Mammoth Creek Fish Community Survey. Prepared by Beak Consultants for the Mammoth County Water District, Mammoth Lakes, California.

Jenkins, T.M., Jr. 1999. Mammoth Creek 1999 Fish Community Survey. Prepared by Horseshoe Canyon Biological Consultants for the Mammoth County Water District, Mammoth Lakes, California.

Jenkins, T.M., Jr., and D.R. Dawson. 1996. Mammoth Creek 1995 Fish Community Survey. Prepared by Sierra Nevada Aquatic Research Laboratory for Mammoth County Water District, Mammoth Lakes, California.

Jenkins, T.M., Jr., and D.R. Dawson. 1997. Mammoth Creek 1996 Fish Community Survey. Prepared by Sierra Nevada Aquatic Research Laboratory for Mammoth County Water District, Mammoth Lakes, California.

Jenkins, T.M., Jr., S. Diehl, K. Kratz, and S.D. Cooper. 1999. Effects of population density on individual growth of brown trout in streams. Ecology 80:941-956.

Moyle, P.B. 2002. Inland Fishes of California, 2nd edition. University of California Press, Berkeley, California. 502p.

Moyle, P.B., R.M. Yoshiyama, and R.A. Knapp. 1996. Status of fish and fisheries. Chapter 33 *in* Sierra Nevada Ecosystem Project Final report to Congress, Volume II, Assessments and scientific basis for management options. University of California Centers for Water and Wildland Resources, Davis, CA.

Needham, P.R., and F.K. Cramer. 1943. Movement of trout in Convict Creek, California. Journal of Wildlife Management 7:142-148.

Platts, W.S., and M.L. McHenry. 1988. Density and biomass of trout and char in western streams. General Technical Report INT-241. Ogden, UT: USDA, Forest Service, Intermountain Research Station. 17pp.

Salamunovich, T. 2006. October 2006 Mammoth Creek Fish Community Survey. Final Report. Prepared by Thomas R. Payne & Associates for the Mammoth Community Water District, Mammoth Lakes, California.

Salamunovich, T. 2007. October 2007 Mammoth Creek Fish Community Survey. Final Report. Prepared by Thomas R. Payne & Associates for the Mammoth Community Water District, Mammoth Lakes, California.

Van Deventer, J.S., and W.S. Platts. 1989. Microcomputer software system for generating population statistics from electrofishing data - user's guide for MicroFish 3.0. USDA, Forest Service General Technical Report INT-254. Intermountain Research Station, Ogden, Utah. 29p.

White, G.C., K.P. Burnham, D.L. Otis, and D.R. Anderson. 1978. User's manual for program CAPTURE. Utah State University Press, Logan, Utah. 40p.

White, G.C., D.R. Anderson, K.P. Burnham and D.L. Otis. 1982. Capture-recapture and removal methods for sampling closed populations. Los Alamos National Laboratory Report, LA-8787NERP: 235 pp.

Appendix A

October 2008 Habitat Characteristic Data Sheets

Thomas R. Payne & Associates Electrofishing Survey - Habitat Characteristic Data Form

Stream: MAMMOTH
County: MONO
Date: 10 / 8 / 2008
Reach: BH (upper)
Est. Q: 3-5
Page: 1 of
Air Temp.: 45°F @ 0740
H20 Temp.: 6.6°C @ 0737
Conductivity: 127.3 µS/cm
Air Temp.: @
H20 Temp.: @
Specific Cond.: 196.8 µS/cm
Length: ~~300~~ 308 → 308
gradient: NOT MEASURED
Salinity: 0.1 ppt
@0740 D.O.: 7.41 mg/L
D.O.: 62.8 % Saturation
pH: 7.5
GPS Coord.

[✓ ft] / m	[✓ ft] / m	[✓ ft] / m			
Distance	Width	1/4 Depth	1/2 Depth	3/4 Depth	Mean Depth
0	17.6	0.6	0.7	0.3	
30	12.1	0.5	0.4	0.3	
60	18.3	0.3	0.4	0.6	
90	15.8	0.2	0.35	0.6	
120	15.3	0.4	0.45	0.35	
150	12.0	0.55	0.40	0.50	
180	6.8	0.80	0.55	0.20	
210	10.0	0.40	0.60	0.35	
240	11.9	0.40	0.50	0.40	
270	11.2	0.40	0.45	0.40	
308	11.0	0.70	2.70	0.35	

Mean Width: 12.91 ft
Mean Depth: 0.52 feet
Total Area: 3,976.0 ft
Total Volume: 2,060.29 ft³

Photos: UP & DOWN @ 250 9:46
UPC BOTTOM 0955

Maximum Depth: 2.70 ft

Reach Habitat Characterization:

Habitat types		
Pool	10	%
Run	40	%
Riffle	50	%
POW	0	%
		%

Substrate types		
fines (≤ 2mm or 1/16")	5	%
sand (2-7mm or 1/16-1/4")	5	%
gravel (7-75mm or 1/4-3")	20	%
cobble (75-300mm or 3-12")	55	%
boulder (>300mm or >12")	15	%
bedrock		%

trout spawning: 379 ft²

Fish Cover		
Surface turbulence	25	%
Instream object	20	%
Undercut bank	5	%
Overhanging vegetation (<48")	35	%

Gradient	
FS to top	
FS to bottom	
Elev change	
Distance	
Gradient	

120 RUN 0-15 73-162 268-284
161 RIF 18-73 162-268
27 PL 284 311
0 POW

2
18
89
16
123

73
18
-55

1:2

106

Thomas R. Payne & Associates Electrofishing Survey - Habitat Characteristic Data Form

Stream: MAMMOTH
County: MONO
Date: 10 / 8 / 2008
Reach: BL
Est. Q: 3-5
Page: 1 of
Air Temp.: 59°F @ 1500
H20 Temp.: 10.9°C @ 1455
Conductivity: 143.1 µS/cm
Air Temp.: @
H20 Temp.: @
Specific Cond.: 197.5 µS/cm
Length: 306
gradient: NOT MEASURED
Salinity: 0.1 ppt
D.O.: 8.13 mg/L
D.O.: 74.1 % Saturation
pH: 8.0

[✓ ft] / m	[✓ ft] / m	[✓ ft] / m			
Distance	Width	1/4 Depth	1/2 Depth	3/4 Depth	Mean Depth
0	10.4	0.5	0.5	0,15	
30	6.6	0.3	0.4	0.20	
60	7.0	0.5	0.4	0.5	
90	7.9	0.45	0.3	0.20	
120	7.9	0.15	0.35	0.50	
150	9.9	0.5	0.6	0.7	
180	7.7	0.25	0.45	0.50	
210	7.4	0.20	0.50	0.25	
240	6.2	0.30	0.50	0.15	
270	9.6	0,20	0.35	0.30	
306	15.7	0.25	0.40	0.20	

Mean Width: 8.75 ft
Mean Depth: 0.36 ft
Total Area: 2,678.89 ft^2
Total Volume: 974.14 ft^3

GPS Coord.

Photos: Down & UP @ middle @1416

2@BOTTOM @ 1431
BOTTOM UP @ 1431
TOP @1434

Maximum Depth: 0.75 ft.

Reach Habitat Characterization:

Habitat types	
Pool	% 5
Run	% 45
Riffle	% 50
POW	%
	%

Substrate types	
fines (< 2mm or 1/16")	5 %
sand (2-7mm or 1/16-1/4")	5 %
gravel (7-75mm or 1/4-3")	75 %
cobble (75-300mm or 3-12")	10 %
boulder (>300mm or >12")	5 %
bedrock	%

trout spawning: 1,741 ft^2

65% spawnable

Fish Cover	
Surface turbulence	5 %
Instream object	5 %
Undercut bank	5 %
Overhanging vegetation (<48")	15 %

Gradient	
FS to top	
FS to bottom	
Elev change	
Distance	
Gradient	

Thomas R. Payne & Associates Electrofishing Survey - Habitat Characteristic Data Form

Stream: MAMMOTH CRK County: MONO Date: 10 / 9 / 2009

Reach: CH Est. Q: 7 cfs Page: 1 of

Air Temp.: 55°F @ 0946 H20 Temp.: 6.6°C @ 0944 Conductivity: 129.0 µS/cm

Air Temp.: @ H20 Temp.: @ Specific Cond.: 199.1 µS/cm

Length: 306 gradient: NOT MEASURED Salinity: 0.1 ppt

D.O.: 9.04 mg/L

D.O.: 74.2 % Saturation

pH: 8.0

[✓ ft] / m	[✓ ft] / m	[✓ ft] / m			
Distance	Width	1/4 Depth	1/2 Depth	3/4 Depth	Mean Depth
0	18.8	0.45	0.75	0.90	
31	22.1	1.65	1.55	1.00	
62	17.0	0.40	0.75	1.10	
93	10.3	0.70	1.50	1.75	
124	12.9	0.70	0.50	0.60	
155	12.6	0.25	0.60	0.90	
186	7.8	0.50	0.95	0.85	
217	11.7	0.95	0.80	0.35	
248	10.2	1.30	0.90	0.90	
279	10.6	0.90	1.05	1.15	
306	8.7	1.00	0.75	0.60	

Mean Width 12.97 ft **Mean Depth** 0.88 ft*

Total Area 3,969.65 ft^2 **Total Volume** 3,489.45 ft^3

GPS Coord.

Photos: UP @ BOTTOM 1121
DOWN @ TOP 1132

Maximum Depth 2^{45} ft

2^{15} 2^{45}

Reach Habitat Characterization:

Habitat types		
Pool	15	%
Run	60	%
Riffle	20	%
POW	5	%
		%

Substrate types		
fines (< 2mm or 1/16")	5	%
sand (2-7mm or 1/16-1/4")	5	%
gravel (7-75mm or 1/4-3")	15	%
cobble (75-300mm or 3-12")	40	%
boulder (>300mm or >12")	35	%
bedrock		%

trout spawning: 80 ft^2

5
10
20
40
5

Fish Cover		
Surface turbulence	5	%
Instream object	45	%
Undercut bank	10	%
Overhanging vegetation (<48")	35	%

Gradient	
FS to top	
FS to bottom	
Elev change	
Distance	
Gradient	

Thomas R. Payne & Associates Electrofishing Survey - Habitat Characteristic Data Form

Stream: MAMMOTH CRK
County: MONO
Date: 10 / 9 /2008
Reach: CL
Est. Q: ~7 cfs
Page: 1 of
Air Temp.: 62°F @ 1455 H20 Temp.: 9.5°C @ 1455
Conductivity: 140.1 µS/cm
Air Temp.: @ H20 Temp.: @
Specific Cond.: 198.6 µS/cm
Length: 318
gradient: NOT MEASURED
Salinity: 0.1 ppt
D.O.: 824 mg/L
D.O.: 72.6 % Saturation
pH: 8.0

(ft)/ m	(ft)/ m		(ft)/ m		
Distance	Width	1/4 Depth	1/2 Depth	3/4 Depth	Mean Depth
0	16.5	0.60	1.10	0.90	
32	15.3	0.60	0.45	0.40	
64	23.2	0.70	0.60	0.35	
96	21.1	0.90	0.60	0.25	
128	24.9	0.85	0.50	0.70	
160	21.9	1.40	1.00	1.00	
192	16.7	0.70	0.80	0.30	
224	23.7	0.30	0.40	0.50	
256	21.5	0.75	0.80	0.40	
288	21.0	1.60	1.50	0.85	
318	15.2	1.10	1.75	1.55	

Mean Width	20.09 ft	**Mean Depth**	0.79 ft
Total Area	6,388.91 ft^2	**Total Volume**	5,072.41 ft^3

GPS Coord.

Photos:

Maximum Depth $2^{\underline{35}}$ ft

Reach Habitat Characterization:

Habitat types		
Pool	30	%
Run	30	%
Riffle	25	%
POW	15	%
		%

Substrate types		
fines (< 2mm or 1/16")	5	%
sand (2-7mm or 1/16-1/4")	10	%
gravel (7-75mm or 1/4-3")	10	%
cobble (75-300mm or 3-12")	35	%
boulder (>300mm or >12")	40	%
bedrock		%

trout spawning: 296 ft²

+ 47

249

9
25
15
6x18
15
30

202

4x5 = 20
3x6 18
3x3 = 9

Fish Cover		
Surface turbulence	20	%
Instream object	65	%
Undercut bank	10	%
Overhanging vegetation (<48")	30	%

Gradient	
FS to top	
FS to bottom	
Elev change	
Distance	
Gradient	

STEVE CLARK
Tim KLAMATH
31,278

0
RUN 18
PW 30
RIF 68
POOL 80
RUN 105
PW 117
POOL 128
RIF 141
POOL 171
~~[illegible]~~ 185
RUN 216
RF 232
RUN 249
POW 261
~~RIF~~ 270
POOL

Thomas R. Payne & Associates Electrofishing Survey - Habitat Characteristic Data Form

Stream: MAMMOTH CRK County: MONO Date: 10 / 10 / 2008
Reach: DH Est. Q: 7-10 cfs Page: 1 of
Air Temp.: @ H20 Temp.: 4.4°C @ 1425 Conductivity: 100.0 µS/cm
Air Temp.: @ H20 Temp.: @ Specific Cond.: 165.0 µS/cm
Length: 333 gradient: NOT DONE Salinity: 0.1 ppt
D.O.: 9.62 mg/L
D.O.: 74.6 % Saturation
pH: 8.0
GPS Coord.
Photos:

[✓ ft] / m	[✓ ft] / m	[✓ ft] / m			
Distance	Width	1/4 Depth	1/2 Depth	3/4 Depth	Mean Depth
0	13.2	1.45	1.20	0.85	
32	11.5	1.50	1.55	1.55	
64	11.7	2.60	2.55	2.10	
96	10.7	0.85	0.70	1.00	
128	10.1	0.40	0.55	0.70	
160	10.9	1.20	0.80	0.60	
192	9.6	0.50	0.65	0.30	
224	10.3	0.9	0.95	0.50	
256	7.9	0.75	0.80	0.70	
288	7.1	0.40	1.15	0.60	
323	8.7	0.70	0.85	0.60	

Mean Width 10.15 ft Mean Depth 0.99 ft
Total Area 3,381.46 ft² Total Volume 3,340.48

Maximum Depth 2.70 ft.

Reach Habitat Characterization:

Habitat types		
Pool	25	%
Run	70	%
Riffle	5	%
POW		%
		%

Substrate types		
fines (< 2mm or 1/16")	5	%
sand (2-7mm or 1/16-1/4")	10	%
gravel (7-75mm or 1/4-3")	25	%
cobble (75-300mm or 3-12")	45	%
boulder (>300mm or >12")	15	%
bedrock		%

trout spawning: 656 ft²

(124) 28x7
46 x 6
13 x 6
+ 15
15
15x6

Fish Cover		
Surface turbulence	15	%
Instream object	15	%
Undercut bank	5	%
Overhanging vegetation (<48")	45	%

Gradient	
FS to top	
FS to bottom	
Elev change	
Distance	
Gradient	

124 - 142 · x6
160 - 206
222 - 235

RN 35
PL 82
RUN 99
POOL 119
RUN 185

RF 210
RUN 235
PL 246
RN 333

Thomas R. Payne & Associates Electrofishing Survey - Habitat Characteristic Data Form

Stream: MAMMOTH CRK
County: MONO
Date: 10 / 10 / 2008
Reach: DL
Est. Q: 8-10 cfs
Page: 1 of
Air Temp.: @
H20 Temp.: 3.3°C @ 0936
Conductivity: 97.3 µS/cm
Air Temp.: @
H20 Temp.: @
Specific Cond.: 165.9 µS/cm
Length: 295
gradient:
Salinity: 0.1 ppt
D.O.: 10.2 mg/L
D.O.: 76.7 % Saturation
pH: 8.0
GPS Coord.
Photos:

[✓ ft] / m	[✓ ft] / m		[✓ ft] / m		
Distance	Width	1/4 Depth	1/2 Depth	3/4 Depth	Mean Depth
0	20.0	0.55	0.80	0.50	
30	14.6	1.60	1.35	0.90	
60	8.9	1.10	0.80	0.55	
90	18.0	1.25	0.50	0.55	
120	18.5	0.70	0.90	0.40	
150	14.3	1.05	0.80	0.60	
180	13.5	0.70	0.65	1.00	
210	20.1	0.45	0.40	0.60	
240	15.5	0.5	0.80	1.05	
270	12.0	0.40	1.10	0.80	
295	23.5	0.50	0.60	0.40	

Mean Width	16.26 ft	**Mean Depth**	0.75 ft
Total Area	4,797.77	**Total Volume**	3,612.87 ft^3

Maximum Depth 1.60 ft

1.6

Reach Habitat Characterization:

Habitat types		
Pool	40	%
Run	25	%
Riffle	35	%
POW		%
		%

Substrate types		
fines (< 2mm or 1/16")	5	%
sand (2-7mm or 1/16-1/4")	5	%
gravel (7-75mm or 1/4-3")	20	%
cobble (75-300mm or 3-12")	40	%
boulder (>300mm or >12")	25	%
bedrock	5	%

trout spawning: 135 ft^2

15
9
8x6
6x5
6x4
3x3

Fish Cover		
Surface turbulence	20	%
Instream object	45	%
Undercut bank	30	%
Overhanging vegetation (<48")	30	%

Gradient	
FS to top	
FS to bottom	
Elev change	
Distance	
Gradient	

0
RN 15
PL 30
RF 38
RN 65
RN 104
RF 125
RN 137
PL 173
RN 226
PL 271
RF 295

Thomas R. Payne & Associates Electrofishing Survey - Habitat Characteristic Data Form

Stream: MAMMOTH
County: MONO
Date: 10 / 11 / 2008
Reach: EH
Est. Q: ~ 10 CFS
Page: ..1 of
Air Temp.: 29°F @ 0915
H20 Temp.: 0.2°C @ 0907
Conductivity: 80.0 µS/cm
Air Temp.: @
H20 Temp.: @
Specific Cond.: — NO READING ON METER µS/cm
Length: 294
gradient:
Salinity: 0.1 ppt
D.O.: 11.37 mg/L
D.O.: 78.5 % Saturation
pH: 7.5

	ft/m	ft/m	ft/m			
	Distance	Width	1/4 Depth	1/2 Depth	3/4 Depth	Mean Depth
	0	16.0	0.40	1.05	0.90	
	29	21.2	0.60	1.25	1.15	
	58	21.4	0.70	0.75	0.40	
	87	22.8	0.50	0.90	0.50	
	116	18.2	0.45	1.05	0.55	
5	145	13.4	0.40	0.80	0.90	
18	174	14.9	0.40	0.50	0.50	
7	203	10.3	1.10	1.30	1.00	
0	232	17.9	0.75	0.40	0.30	
9	261	13.4	0.50	0.50	0.45	
	294	21.6	0.35	0.70	0.70	

Mean Width 17.37 ft
Mean Depth 0.69 ft
Total Area 5,107.58 ft²
Total Volume 3,513.40 ft³

GPS Coord.

Photos: SEVERAL

Maximum Depth 1.80 ft

Reach Habitat Characterization:

Habitat types		
Pool	10	%
Run	70	%
Riffle	20	%
POW		%
		%

Substrate types		
fines (< 2mm or 1/16")	10	%
sand (2-7mm or 1/16-1/4")	10	%
gravel (7-75mm or 1/4-3")	35	%
cobble (75-300mm or 3-12")	40	%
boulder (>300mm or >12")	5	%
bedrock		%

trout spawning: 379 ft²

5x5
3x8
3x30
4x28
3x3
2x8
3x3
7x3
3x3
9x3
15x3

Fish Cover		
Surface turbulence	5	%
Instream object	10	%
Undercut bank	20	%
Overhanging vegetation (<48")	40	%

Gradient	
FS to top	
FS to bottom	
Elev change	
Distance	
Gradient	

66-14-7 88±3 se ·1581 p·0.737
12-8-2 23±4 se· 2.027 p: .595

Thomas R. Payne & Associates Electrofishing Survey - Habitat Characteristic Data Form

Stream: MAMMOTH CRK
County: MONO
Date: 10 / 11 / 2008
Reach: EL
Est. Q: 10 CFS
Page: 1 of 1
Air Temp.: 34°F @ 1321
H20 Temp.: 3.6 @ 1321
Conductivity: 106.6 µS/cm
Air Temp.: @
H20 Temp.: @
Specific Cond.: 180.3 µS/cm
Length: 308
gradient: NOT MEASURED
Salinity: 0.1 ppt
D.O.: 11.06 mg/L
D.O.: 83.9 % Saturation
pH: 7.5

[✓ ft] / m	[✓ ft] / m	[✓ ft] / m			
Distance	Width	1/4 Depth	1/2 Depth	3/4 Depth	Mean Depth
0	18.9	1.9	1.9	1.35	
31	12.2	1.35	1.50	1.15	
62	14.9	1.45	1.50	0.80	
93	16.4	0.70	0.60	0.80	
124	13.0	0.70	1.50	1.30	
155	11.5	0.25	1.50	1.75	
186	17.4	0.30	0.95	0.70	
217	11.4	0.80	1.80	0.55	
248	16.6	0.45	0.30	0.40	
279	17.5	0.20	0.30	0.55	
308	15.2	0.45	0.45	0.50	

Mean Width	15.00 ft	**Mean Depth**	0.93 ft
Total Area	4,620.00 ft²	**Total Volume**	4298.00 ft³

GPS Coord.

Photos:

Maximum Depth 2.70 ft.

Reach Habitat Characterization:

Habitat types		
Pool	30	%
Run	50	%
Riffle	20	%
POW		%
		%

Substrate types		
fines (< 2mm or 1/16")	15	%
sand (2-7mm or 1/16-1/4")	10	%
gravel (7-75mm or 1/4-3")	50	%
cobble (75-300mm or 3-12")	20	%
boulder (>300mm or >12")	5	%
bedrock		%

trout spawning: 1,727 ft²

Fish Cover		
Surface turbulence	5	%
Instream object	5	%
Undercut bank	20	%
Overhanging vegetation (<48")	5	%

Gradient	
FS to top	
FS to bottom	
Elev change	
Distance	
Gradient	

4x8
5x20
5x6
3x5
15x36
15x6
6x20
16x50

Appendix B

October 2008 Electrofishing Fish Data Sheets

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth Crk County: MONO Date: 10 / 8 / 08

Reach: BH Est. Q: 3-5 Page: 1 of 6

Air Temp.: @ H20 Temp.: @ Conductivity: microSiemens

Blocknets: Btm ONLY / TOP @ CULVERT Specific Cond.: microSiemens

Reach Length: 308 Salinity: ppt

Electroshocker Type: D.O.: mg/L

Personnel: Shockers: ST % saturation

SE pH:

Photos:

Netters: TS

RL

Shocker	SE	ST	~~SE~~	~~ST~~
Model	12A	11-A	~~12A~~	~~11A~~
Battery ID	POWELL	CLARK		
Voltage:	300	300	~~300~~	~~300~~
Frequency:	60	60	~~60~~	~~60~~
1st Pass	2226	1794	~~1994~~	~~1375~~
2nd Pass	1994	1375		
3rd Pass	1885	1342		
4th Pass				
5th Pass				

Lengths are fork lengths or total lengths in millimeters **Weights are in grams**

	Pass#	Species	Length	Weight	Scale Sample	Notes
	1	Brn	88	7.3		
		Brn	79	6.0		RBT 20 - 10 - 4
		Brn	89	8.0		BRN 131 - 42 - 23
1		RBT	67	3.6		BRK 1 - 0 - 0
		Brn	89	7.6		
		Brn	210	105.3		
		Brn	172	58.0		
		Brn	214	103.7		3 PASS BROWN Σ=196
		Brn	59	2.5		N = 207
1		RBT	61	2.7		SE 5.3
1		RBt	62	3.0		N= 207 ± 10
1		RBT	57	2.5		P= 0.618
		Brn	86	6.8		
		Brn	95	10.8		
		Brn	80	5.7		
		Brn	81	5.4		
		Brn	79	6.1		
		Brn	80	5.5		
		Brn	76	5.0		
		Brn	89	8.9		
1		RBT	69	4.1		
		Brn	67	3.7		
1		RBT	61	2.5		
		Brn	173	60.6		
	↓	Brn	240	159.9		

RBT 6
BRN 19

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth Crk Date: 10 / 8 / 08 Page: 2 of 6

Reach: BH (continued)

	Pass#	Species	Length	Weight	Scale Sample	Notes
1	1	Rbt	189	88.9		
1		Rbt	195	105.6		
1		Rbt	187	79.2		
		brn	250	166.8		
		brn	275	225.8		
		brn	73	4.3		
		brn	78	5.5		
		brn	87	8.1		
		brn	76	5.7		
		brn	76	4.5		
		brn	82	5.7		
		brn	86	7.3		
			88	7.8		
			79	5.4		
			84	6.2		
			79	6.2		
			87	7.4		
			76	4.8		
			78	5.4		
			75	5.1		
			88	7.5		
		↓	73	4.3		
1		RBT	66	3.8		
		brn	74	4.8		
			73	5.1		
			72	4.5		
			88	8.4		
			88	8.6		
			90	8.1		
			84	8.0		
		↓	63	3.1		
1		RBT	58	2.6		
		Brn	87	7.7		
			79	5.6		
			81	6.6		
			84	6.7		
			84	6.7		
			76	5.4		
			91	8.6		
		↓	82	6.4		
1		RBT	75	4.8		
		Brn	88	8.7		
			76	5.5		
		↓	212	97.4		
1	↓	RBT	155	47.8		

RBT 7 + 7
BRN 38 + 74
BRK 1

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth C-k
Date: 01 8 1 08
Page: 3 of 6

Reach: BH
(continued)

	Pass#	Species	Length	Weight	Scale Sample	Notes
1	1	RBT	235	138.7		
		Brn	69	3.5		
			81	5.7		
			89	9.1		
		↓	81	7.0		
1		RBT	68	3.4		
		Brn	69	3.8		
			84	7.1		
			75	4.9		
			81	5.6		
			90	7.4		
		↓	155	41.1		
/		RBT	165	56.8		
		Brk	131	23.3		
1		RBT	67	3.0		Mort
		Brn	92	9.6		
			84	7.6		
			84	7.4		
			86	7.5		
			87	7.7		
			78	5.8		
			85	6.6		
			83	6.2		
			74	4.5		
			86	7.4		
			72	4.3		
			87	7.4		
			76	5.0		
			73	4.8		
			158	44.9		
			207	102.2		
			215	118.3		
			226	119.7		
			174	59.1		
		↓	173	53.6		
/		RBT	218	116.3		
		Brn.	77	4.9		
			91	9.1		
			82	6.7		
			75	4.1		
			91	8.2		
			90	7.7		
			84	6.6		
			76	4.8		
	↓	↓	84	5.7		

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth crk Date: 10 / 8 / 08 Page: 4 of 6

Reach: BH (continued)

	Pass#	Species	Length	Weight	Scale Sample	Notes
	1	Brn	74	4.4		
			86	7.1		
			79	5.1		
			84	7.3		
			65	3.4		
1		RBT	64	3.3		
		Brn	73	3.7		
			76	4.6		
			90	8.4		
			89	7.9		
			87	7.3		
			80	6.1		
			85	6.8		
			88	7.1		
			79	5.2		
			74	4.3		
			83	6.8		
			70	4.1		
			79	5.5		
			87	7.3		
			86	7.4		Mort
			79	6.4		
			76	4.7		
			72	3.9		
			84	6.3		
			79	5.6		
			79	5.3		
			71	4.0		
			73	3.9		
			80	5.6		
			80	6.1		
			84	6.9		
			87	6.8		
1		RBT	72	4.2		
		Brn	82	6.7		
			67	3.1		
			79	6.5		
	2	Brn	73	5.4		RBT – 10
			81	7.3		BRN – 41
			90	8.0		
1		RBT	68	3.8		
		BRN	82	6.3		

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth Creek Date: 10 / 8 / 08 Page: 5 of 6

Reach: BH (continued)

	Pass#	Species	Length	Weight	Scale Sample	Notes
	2	BRN	82	6,6		
			76	4,6		
			75	5,1		
			81	6.4		
			71	4.1		
		↓	78	5,2		
1		RBT	60	2.7		
		BRN	68	3.8		
		↓	64	3,1		
/		RBT	58	2,5		
		BRN	79	6.5		
		↓	74	4,5		
/		RBT	64	2,7		
		BRN	87	8.3		
			88	8, 6		
			76	4,8		
			77	5,6		
			232	119,2		
			75	4,7		mort
			215	126,8		
			82	6,6		
			86	8,2		
			76	5,8		
			86	7,8		
			75	5,6		
			88	8,5		
			59	2,3		
			79	4,6		
		↓	73	4,1		
/		RBT	65	3.9		
/		RBT	60	3,1		
		Brn	84	6.8		
			93	8.4		
			79	5.8		
			85	7.6		
			80	6.4		
			71	4.5		
		↓	85	6.6		
/		RBT	61	2.4		
/		RBT	65	2.1		
/		RBT	65	2.8		
/		RBT	56	1.7		
		Brn	81	6.4		
			82	6.8		
	↓	↓	86	7.1		

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth Crk Date: 10 / 8 / 08 Page: 6 of 6

Reach: BH (continued)

Pass#	Species	Length	Weight	Scale Sample	Notes
2	Brn	74	4.7		
2	Brn	91	10.0		Mort
3	Brn	275	199.0		
		256	193.5		
		87	8.2		
		80	6.4		
		85	6.9		
		81	5.7		
		90	7.9		
	↓	74	4.2		
	RBT	76	5.1		
	Brn	69	3.6		
		75	4.1		
		74	4.3		
	↓	81	5.6		
	RBT	68	3.0		
	Brn	84	7.1		
		69	3.8		
		83	7.5		
		88	7.4		
		81	6.1		
		96	9.6		
		89	6.8		
		81	5.7		
	↓	77	5.8		
	RBT	67	3.4		
	↓	57	1.9		
	Brn	75	4.6		
	↓	73	4.7		

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth Crk
County: MONO
Date: 6 / 8 / 08

Reach: BL
Est. Q: 3-5
Page: 1 of 2

Air Temp.: @
H20 Temp.: @
Conductivity: microSiemens

Blocknets: Top + btm
Specific Cond.: microSiemens

Reach Length: 306
Salinity: ppt

Electroshocker Type:
D.O.: mg/L

% saturation

Personnel: Shockers: TS
SE

pH:
Photos:

Netters: ST
RL

Shocker	TS	SE	~~TS~~	~~SE~~						
Model	11A	12A	~~11A~~	~~12A~~						
Battery ID	Columbia									
Voltage:	300	300								
Frequency:	60	60								
1st Pass	960	998	~~714~~	~~779~~						
2nd Pass	714	779	~~714~~	~~779~~						
3rd Pass	685	690								
4th Pass										
5th Pass										

Lengths are fork lengths or total lengths in millimeters **Weights are in grams**

Pass#	Species	Length	Weight	Scale Sample	Notes
1	Brn	192	84.1		
|	|	214	128.2		
|	|	224	152.9		Brn 27-3-2 Σ=32
|	|	205	95.1		
|	|	285	215.7		N = 32
|	|	265	216.4		SE 0.482
|	|	171	64.7		ρ = 0.821
|	|	154	44.7		
|	|	185	70.1		N = 32±1
|	|	85	7.1		
|	|	97	10.6		
|	|	89	9.2		
|	|	84	8.2		
|	|	95	10.4		
|	|	98	9.6		
|	|	99	11.6		
|	|	84	6.8		
|	|	93	8.2		
|	|	95	9.0		
|	|	100	12.4		
|	|	92	8.3		
|	|	84	6.6		
|	|	97	10.2		
|	|	72	4.2		
↓	↓	74	4.2		

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth Date: 10/8/08 Page: 2 of 2

Reach: BL (continued)

Pass#	Species	Length	Weight	Scale Sample	Notes
1	Brn	96	10.6		
↓	↓	153	44.7		
2	Brn	80	6.5		
		87	7.6		
↓	↓	245	171.2		
3	Brn	239	157.5		
↓	↓	85	~~6.~~ 7.1		

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: MAMMOTH CRK
County: MONO
Date: 10 / 9 / 2008
Reach: CH
Est. Q: ~7 cfs
Page: 1 of 2
Air Temp.: @
H20 Temp.: @
Conductivity: microSiemens
Blocknets: Top + Btm
Specific Cond.: microSiemens
Reach Length:
Salinity: ppt
Electroshocker Type:
D.O.: mg/L
% saturation
Personnel: Shockers: SE
ST
pH:
Photos:
Netters: TS, RL

Shocker	SE	ST							
Model	12-B	11-A							
Battery ID	POWELL	Columbia							
Voltage:	300	300							
Frequency:	60	60							
1st Pass	1622	1222							
2nd Pass	1304	1086							
3rd Pass	1248	1133							
4th Pass									
5th Pass									

Lengths are fork lengths or total lengths in millimeters **Weights are in grams**

Pass#	Species	Length	Weight	Scale Sample	Notes
1	BRN	222	120.6	N	
	"	218	111.7		
	"	174	62.2		BRN 46 - 10 - 5
	"	175	66.0		Σ = 61
	RBT	355	482.0		Hatchery fish N = 62 ± 3 SE = 1.437 p=0.726
	BRN	189	78.9		
	"	155	39.9		RBT
	"	92	8.9		7 - 0 - 0 Σ = 7
	"	86	8.9		
	"	95	10.0		
	"	100	11.3		
	"	92	10.1		
	"	102	13.4		
	"	248	182.8		
	RBT	242	165.8		WILD
	BRN	178	69.9		
	"	250	163.7		
	RBT	142	36.0		WILD
	"	286	244.0		Hatchery fish
	BRN	201	98.6		
	"	182	66.7		
	BRN	103	11.2		
	"	109	13.9		
	"	104	13.4		
	"	105	13.7		

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth Cr. Date: 10 / 9 / 08 Page: 2 of 2

Reach: CH (continued)

Pass#	Species	Length	Weight	Scale Sample	Notes
1 (cont.)	BRN	102	11.5	N	
	"	108	14.5		
	"	104	12.6		
	"	104	12.7		
	"	152	47.8		
	"	204	105.0		
	"	172	63.8		
	RBT	211	124.1		WILD
	BRN	173	58.3		
	"	216	119.9		
	"	169	57.1		
	RBT	310	330.0		Hatchery fish
	BRN	166	54.9		
	"	184	75.5		
	"	178	67.6		
	"	241	148.6		
	"	91	9.8		
	"	101	12.2		
	"	102	13.1		
	"	101	12.8		
	"	101	12.0		
	"	86	8.1		
	"	89	9.1		
	"	105	14.5		
	"	103	12.6		
	RBT	96	10.6		WILD
	BRN	105	13.5		
↓	"	92	8.4		Pass 1 count : 7-RBT, 46-BRN
2	Brn	189	84.9		
		162	53.3		
		206	106.7		
		96	11.2		
		104	12.0		
		111	15.6		
		98	10.9		
		106	14.2		
		90	8.1		
	↓	89	8.2		
		-			Pass 2 : 10 Brn
3	BRN	75	5.0		mort
3	BRN	108	15.2		
3	BRN	100	11.1		
3	BRN	104	14.7		
3	BRN	99	10.8		

end pass #3

1133

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: MAMMOTH CRK County: MONO Date: 10 / 9 / 2008

Reach: CL Est. Q: ~7cfs Page: 1 of 2

Air Temp.: @ H20 Temp.: @ Conductivity: microSiemens

Blocknets: Top + Btm Specific Cond.: microSiemens

Reach Length: Salinity: ppt

Electroshocker Type: D.O.: mg/L

Personnel: Shockers: SE , TS % saturation

pH:

Photos:

Netters: RL, ST

Shocker	SE	TS							
Model	12-B	11-A							
Battery ID	Clark	Klamath							
Voltage:	300	300							
Frequency:	60	60							
1st Pass	1722	1838							
2nd Pass	1373	1366							
3rd Pass	1152	1278							
4th Pass									
5th Pass									

Lengths are fork lengths or total lengths in millimeters Weights are in grams

Pass#	Species	Length	Weight	Scale Sample	Notes
1	RBT	253	204.2	N	Hatchery Fish BRN
	RBT	305	306.7		" " 20-7-2 Σ= 29
	BRN	253	189.5		N= 29 ± 2
	"	274	213.7		SE = 0.991
	"	102	11.3		p= 0.725
	"	116	18.6		
	"	112	17.8		
	"	106	12.5		RBT 7-0-1
	"	91	9.1		N= 8 ± 1
	"	109	14.5		SE: 0.290
	"	120	20.6		p= 0.800
	"	236	158.6		
	"	216	126.5		
	RBT	250	207.4		Hatchery Fish HATCHERY RBT
	RBT	278	236.9		" " 6-0-1
	RBT	232	166.4		" " N=7 ± 1
	RBT	210	124.6		wild SE = 0.327
	RBT	305	310.1		Hatchery Fish p= 0.778
	BRN	238	177.7		
	"	212	113.6		
	"	305	314.9		
	"	96	10.2		
	"	107	14.9		
	"	106	13.2		
	"	102	12.4		

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth Cr. Date: 10 / 9 / 08 Page: 2 of 2

Reach: CL (continued)

Pass#	Species	Length	Weight	Scale Sample	Notes
1 (cont.)	BRN	103	12.7	N	
"	"	110	14.9	"	Pass 1 count : 7- RBT, 20 BRN
2	BRN	112	14.5	N	
	"	104	12.9		
	"	102	11.9		
	"	96	9.6		
	"	95	10.3		
	"	115	16.2		
	"	105	11.9		Pass 2 count : 0-RBT, 7- BRN
3	RBT	318	382.4	N	Hatchery fish
	BRN	110	16.0		
	"	119	20.3		Pass 3 count : 1 - RBT, 2-BRN

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: MAMMOTH CRK County: MONO Date: 10 / 10 / 2008

Reach: DH Est. Q: Page: 1 of 2

Air Temp.: @ H20 Temp.: @ Conductivity: microSiemens

Blocknets: TOP & BOTTOM Specific Cond.: microSiemens

Reach Length: Salinity: ppt

Electroshocker Type: D.O.: mg/L

Personnel: Shockers: % saturation

pH:

Photos:

Netters:

Shocker	SE	ST							
Model	12A	11A							
Battery ID									
Voltage:	300	300							
Frequency:	60	60							
1st Pass	1311	1099							
2nd Pass	809	711							
3rd Pass	712	707							
4th Pass									
5th Pass									

Lengths are fork lengths or total lengths in millimeters **Weights are in grams**

	Pass#	Species	Length	Weight	Scale Sample	Notes
	#1	BRN	126	28.4		
		"	206	99.9		RBT - 12
		"	224	117.8		BRN - 48
		"	195	81.8		
		"	93	9.7		
		"	82	7.4		
		"	156	41.8		BRN 48-4-3
		"	152	37.4		N = 55 ± 1
		"	139	30.5		SE = 0.487 p=.846
1		RBT	198	89.2		W
		BRN	87	7.9		
		"	167	56.6		RBT 12-2-1
		"	215	114.5		N = 15 ± 1
		"	169	58.2		SE = 0.435 p=0.789
		"	147	35.6		
		"	187	75.2		
		"	87	7.1		WILD HATCHERY
		"	188	81.3		5-1-0 7-1-1
1		RBT	65	3.5		W N=6 ± 1 N>9 ± 1
		BRN	85	7.3		SE = 0.142 SE = 0.461
		"	257	168.3		p = 0.857 p = 0.750
		"	142	32.1		
		"	156	41.8		
		"	184	65.5		
		"	161	46.4		

SNOWING ?

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth Creek   Date: 10/10/08   Page: 2 of 2

Reach: DH   (continued)

	Pass#	Species	Length	Weight	Scale Sample	Notes
	#1	BRN	74	5.0		
		"	92	8.9		
		"	86	6.7		
		"	106	13.5		
		"	102	12.2		
/		RBT	271	239.9		H
/		RBT	253	192.1		H
		BRN	253	167.2		
		"	91	8.6		
		"	85	6.2		
		"	101	11.1		
		"	95	9.1		
/		RBT	281	234.8 ←	234.8	H
/		RBT	234	154.9		H
/		RBT	286	249.5		H
		BRN	191	83.1		
		"	203	102.7		
		"	193	75.9		
/		RBT	245	182.4		H
		BRN	210	98.5		
		"	262	192.9		
		"	162	49.8		
		"	171	55.8		
/		RBT	283	255.2		H
/		RBT	140	31.3		W
/		RBT	175	68.8		W
		BRN	192	73.4		
		"	165	51.0		
		"	201	87.5		
/		RBT	208	114.7		W
		BRN	106	13.2		
		"	86	7.5		
		"	104	12.4		
		"	91	7.7		
		"	93	8.8		
	#2	RBT	222	155.4		H PASS 2 BRN - 4
		RBT	216	126.7		W RBT - 2
		BRN	194	83.5		
		BRN	101	12.8		
		BRN	83	6.7		
	#2	BRN	94	10.0		
	#3	BRN	95	9.7		PASS 3 BRN-3
		BRN	94	9.5		RBT-1
		BRN	206	98.4		
		RBT	305	314.8		H

end

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: MAMMOTH CRK County: MONO Date: 10/ 10 / 2008

Reach: DL Est. Q: Page: 1 of 2

Air Temp.: @ H20 Temp.: @ Conductivity: microSiemens

Blocknets: TOP & BOTTOM Specific Cond.: microSiemens

Reach Length: 295 Salinity: ppt

Electroshocker Type: D.O.: mg/L

Personnel: Shockers: % saturation

pH:

Photos:

Netters:

Shocker	TS	SE							
Model	11A	12A							
Battery ID	COLUMBIA	CLARK							
Voltage:	300	300							
Frequency:	60	60							
1st Pass	1460	1311							
2nd Pass	1286	1101							
3rd Pass	1062	902							
4th Pass									
5th Pass									

Lengths are fork lengths or total lengths in millimeters **Weights are in grams**

	Pass#	Species	Length	Weight	Scale Sample	Notes	
1	#1	RBT	190	85.4		W	
1		RBT	231	156.2		W	#1 RBT - 17
1		RBT	287	289.4		(H)	BRN - 12
1		RBT	205	112.1		W	
		BRN	169	68.5			
		"	260	177.1			BRN 12-1-1 (14)
		"	234	161.2			N= 14 ± 1
		"	261	163.7			SE = 0.309 P= 0.824
		"	192	84.9			
1		RBT	235	164.8		W	RBT 17-2-1 (20)
1		RBT	219	136.1		W	N= 20 ± 1
1		RBT	243	173.0		W	SE= 0.336 P= 0.833
1		RBT	214	125.9		W	
		BRN	270	197.0			
		"	169	52.9			WILD RBT
		"	239	144.8			16-2-1
		"	88	8.9			N= 19± 1
1		RBT	102	13.6		W	SE = 0.352 P= 0.826
1		RBT	90	9.3		W	
		BRN	104	14.5			
1		RBT	96	~~14.1~~ 13.8		W	HATCHERY RBT
1		RBT	97	10.8		W	1-0-0
		BRN	97	11.8			
1		RBT	104	15.7		W	
1		RBT	104	15.9		W	

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth Creek Date: 10 / 10 / 08 Page: 2 of 2

Reach: DL (continued)

Pass#	Species	Length	Weight	Scale Sample	Notes
# 1	BRN	107	17.4		
	RBT	86	7.8		W
	RBT	91	10.0		W
	RBT	104	15.3		W
#2	RBT	226	139.2		W #2 RBT - 2
	BRN	236	147.9		BRN - 1
	RBT	101	13.1		W
#3	RBT	96	11.7		W
	BRN	98.	10.2		

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth Crk
County: MONO
Date: 10 / 11 / 08
Reach: EH
Est. Q: ~10 cfs
Page: 1 of 3
Air Temp.: @
H20 Temp.: 0.2°C @ 0916
Conductivity: microSiemens
Blocknets: Top N' bottom
Specific Cond.: microSiemens
Reach Length:
Salinity: ppt
Electroshocker Type:
D.O.: mg/L
% saturation
Personnel: Shockers: ST
SE
pH:
Photos:
Netters: RL
TS

Shocker	ST	SE							
Model	11A	12B							
Battery ID	Klamath	Clark							
Voltage:	600	600							
Frequency:	30	30							
1st Pass	1117	1265							
2nd Pass	1088	1141							
3rd Pass	993	1055							
4th Pass									
5th Pass									

Lengths are fork lengths or total lengths in millimeters **Weights are in grams**

Pass#	Species	Length	Weight	Scale Sample	Notes
1	RBT	245	184.3	N	HATCHERY
		221	119.1		H RBT - 12 - 8 - 2
	↓	242	198.0		H Brn - 66 - 15 - 7
	Brn	142	31.9		
	RBT	82	7.3		WILD
	Brn	90	8.8		
		78	7.0		
		136	30.7		
		202	97.2		
		140	48.2		
		119	18.6		
		165	50.3		
		150	35.4		
		155	40.2		
		156	42.2		
	↓	157	43.3		
	RBT	237	178.0		H
	Brn	141	32.1		
		173	57.7		
		174	58.6		
		175	59.7		
		218	121.7		
		148	35.9		
		155	42.7		
↓	↓	210	99.8	↓	

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth Crk　Date: 10/11/08　Page: 2 of 3

Reach: EH　(continued)

Pass#	Species	Length	Weight	Scale Sample	Notes
1	Brn	88	7.3	N	
		94	9.1		
		98	11.9		
		92	9.8		
		156	41.2		
		158	46.9		
		99	10.5		
		143	36.3		
		171	61.7		
		161	51.9		
		176	72.8		
		162	45.2		
		167	54.1		
		169	49.5		
		89	8.4		
		89	8.8		
		99	11.6		
		146	32.6		
	↓	220	115.7		
	RBT	260	225.4		H
		225	167.3		4
		225	138.7		H
		228	132.1		H
	↓	234	156.5		H
	Brn	171	64.5		
	RBt	242	168.1		H
	↓	278	244.3		H
	Brn	235	142.0		
		153	43.6		
		170	58.1		
		154	41.9		
		158	46.1		
		93	9.7		
		208	94.8		
		101	10.6		
		82	6.0		
		184	70.7		
		212	103.2		
		180	63.6		
		160	44.1		
		214	113.6		
		190	83.3		
		85	7.7		
		242	149.2		
↓	↓	90	8.5		

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth crk   Date: 10/11/08   Page: 3 of 3

Reach: EH   (continued)

Pass#	Species	Length	Weight	Scale Sample	Notes
1	Brn	165	53.0	N	
		153	36.9		
		152	39.7		
		160	47.7		
		95	9.7		
		158	51.1		
		158	44.2		
↓	↓	165	49.9		
≠					
2	RBT	250	227.3	N	H
	Brn	235	156.5		
	↓	139	33.6		
	RBT	242	156.1		H
	↓	102	16.3		W
	Brn	182	64.9		
		124	21.0		
	↓	146	37.5		
	RBT	75	6.0		W
		195	87.0		W
		64	2.6		W
	↓	95	9.2		W
	Brn	88	8.1		
		155	41.5		
		151	40.0		
	↓	168	55.7		
	RBT	175	65.7		W
	Brn	158	46.9		
		141	34.3		
		140	30.1		
		155	38.9		
		152	37.9		
↓	↓	91	8.2		
≠					
3	RBT	75	6.3		W
	↓	86	8.2		W
	Brn	96	11.6		
		92	9.5		
		152	41.9		
		154	42.5		
		136	29.9		
		176	62.5		
↓	↓	172	60.6		
≠					

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth Cr.
County: MONO
Date: 10 / 11 / 07

Reach: EL
Est. Q: ~10 cfs
Page: 1 of 3

Air Temp.: @
H20 Temp.: 3.3 °c @ 13:21
Conductivity: microSiemens

Blocknets: Top + Btm
Specific Cond.: microSiemens

Reach Length:
Salinity: ppt

Electroshocker Type:
D.O.: mg/L

Personnel: Shockers: TS, SE
% saturation

pH:

Photos:

Netters: RL, ST

Shocker	TS	SE							
Model	11-A	12-B							
Battery ID	Columbia	Powell							
Voltage:	300	300							
Frequency:	60	60							
1st Pass	1031	878							
2nd Pass	743	656							
3rd Pass	713	666							
4th Pass									
5th Pass									

Lengths are fork lengths or total lengths in millimeters Weights are in grams

Pass#	Species	Length	Weight	Scale Sample	Notes
1	BRN	97	9.8	N	
	"	90	8.9		
	"	162	55.8		
	"	155	47.1		
	"	190	91.0		
	RBT	124	21.8		WILD
	BRN	392	257.9		
	"	173	64.7		
	"	173	57.3		
	"	168	53.1		
	"	88	8.1		
	"	160	48.4		
	"	194	90.2		
	"	143	38.1		
	RBT	194	83.1		WILD
	"	227	132.9		WILD
	SKR	45	1.0		
	BRN	315	311.6		
	RBT	228	134.9		WILD
	BRN	138	30.2		
	RBT	164	54.0		WILD
	"	215	138.1		WILD
	BRN	184	76.2		
	"	247	175.2		
	"	194	79.3		

18 BRN
6 RBT
1 SKR

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth Cr

Date: 10 / 11 / 08

Page: 2 of 3

Reach: EL (continued)

Pass#	Species	Length	Weight	Scale Sample	Notes
1 (cont.)	BRN	174	64.9	N	
	"	197	93.3		
	"	194	90.1		
	RBT	122	27.9		W
	"	179	68.7		W
	BRN	171	58.5		
	"	246	184.5		
	"	169	59.3		
	RBT	189	76.4		W
	"	132	31.0		W
	BRN	175	65.2		
	"	193	87.3		
	RBT	96	11.2		W
	"	238	150.9		Hatchery fish
	BRN	190	82.4		
	"	182	62.8		
	"	160	47.4		
	"	213	111.0		
	"	76	6.1		
	"	188	82.2		
	"	191	76.3		
	RBT	139	36.9		W
	BRN	166	51.2		
	"	156	55.6		
	"	217	116.0		
	"	176	64.2		
	"	163	62.4		
	"	177	72.6		
	"	90	10.1		
	RBT	117	19.5		W
	"	131	33.5		W
	BRN	85	8.3		
	"	169	56.4		
	"	244	165.1		
	"	189	82.3		
	"	172	58.8		
	"	183	69.6		
	"	167	56.3		
	RBT	102	14.1		W
	BRN	178	58.5		
	SKR	40	0.8		
	SKR	40	0.7		50 - BRN
*	BRN	402	700.9		Pass 1 count = 15 - RBT
	CHB	32	0.4		8 - SKR (4 escaped live cart)
	CHB	31	0.4		3 CHUB
	CHB	31	0.4		
	SKR	41	0.8		

Thomas R. Payne & Associates Electrofishing Survey - Fish Data Form

Stream: Mammoth Cr.   Date: 10 / 11 / 08   Page: 3 of 3

Reach: EL (continued)

Pass#	Species	Length	Weight	Scale Sample	Notes
2	CHB	32	0.4	N	
	SkR	46	0.8		
	BRN	146	39.3		
	"	177	70.8		
	RBT	142	39.7		W
	SkR	39	0.7		
	BRN	156	48.2		
	"	178	66.4		
	"	190	88.1		
	RBT	120	25.3		W
	BRN	247	173.3		
	"	90	9.7		
	"	98	12.3		8 - BRN
	SkR	41	1.0		2 - RBT
	CHB	31	0.4		Pass 2 count 3 - SkR
					2 - CHB
3	Brn	158	43.7		
	RBT	268	195.2		W
	Brn	256	176.9		
≠					

Appendix C

MicroFish 3.0 and Program CAPTURE Output for the October 2008 Electrofishing Data

Stream: Mammoth Creek, Site BH, 8 October 2008
Species: All trout

Removal Pattern: 152 52 27
Total Catch = 231
Population Estimate = 245

Chi Square = 1.518
Pop Est Standard Err = 6.052
Lower Conf Interval = 233.078
Upper Conf Interval = 256.922

Capture Probability = 0.609
Capt Prob Standard Err = 0.039
Lower Conf Interval = 0.534
Upper Conf Interval = 0.685

Stream: Mammoth Creek, Site BH, 8 October 2008
Species: Rainbow trout (all wild - no hatchery trout captured)

Removal Pattern: 20 10 4
Total Catch = 34
Population Estimate = 36

Chi Square = 0.292
Pop Est Standard Err = 2.665
Lower Conf Interval = 34.000
Upper Conf Interval = 41.409

Capture Probability = 0.586
Capt Prob Standard Err = 0.105
Lower Conf Interval = 0.373
Upper Conf Interval = 0.799

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 30.59064 .

Stream: Mammoth Creek, Site BH, 8 October 2008
Species: Brown trout

Removal Pattern: 131 42 23
Total Catch   =   196
Population Estimate   =   207

Chi Square   =   2.050
Pop Est Standard Err   =   5.276
Lower Conf Interval   =   196.606
Upper Conf Interval   =   217.394

Capture Probability   =   0.618
Capt Prob Standard Err =   0.041
Lower Conf Interval   =   0.537
Upper Conf Interval   =   0.700

Stream: Mammoth Creek, Site BH, 8 October 2008
Species: Brook trout

Removal Pattern: 1 0 0
Total Catch   =   1
Population Estimate   =   1 (**Using Program CAPTURE**)

Chi Square   =   0.000
Pop Est Standard Err   =   0.000
Lower Conf Interval   =   1.000
Upper Conf Interval   =   2.000

Capture Probability   =   0.9996

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 0.00.

Stream: Mammoth Creek, Site BL, 8 October 2008
Species: Brown trout (no rainbow trout captured at this site)

Removal Pattern: 27 3 2
Total Catch = 32
Population Estimate = 32

Chi Square = 2.219
Pop Est Standard Err = 0.482
Lower Conf Interval = 32.000
Upper Conf Interval = 32.982

Capture Probability = 0.821
Capt Prob Standard Err = 0.069
Lower Conf Interval = 0.680
Upper Conf Interval = 0.961

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 31.0176 .

Stream: Mammoth Creek, Site CH, 9 October 2008
Species: All trout

Removal Pattern: 53 10 5
Total Catch = 68
Population Estimate = 68

Chi Square = 2.254
Pop Est Standard Err = 1.062
Lower Conf Interval = 68.000
Upper Conf Interval = 70.120

Capture Probability = 0.773
Capt Prob Standard Err = 0.053
Lower Conf Interval = 0.667
Upper Conf Interval = 0.879

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 65.87965 .

Stream: Mammoth Creek, Site CH, 9 October 2008
Species: Rainbow trout (all)

Stream: Mammoth Creek, Site EH, 11 October 2008
Species: Rainbow trout (hatchery)

Removal Pattern: 7 0 0
Total Catch = 7
Population Estimate = 7 (**Using Program CAPTURE**)

Chi Square = 0.000
Pop Est Standard Err = 0.000
Lower Conf Interval = 7.000
Upper Conf Interval = 8.000

Capture Probability = 0.9999

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 6.00.

Stream: Mammoth Creek, Site CH, 9 October 2008
Species: Rainbow trout (wild)

Removal Pattern: 4 0 0
Total Catch = 4
Population Estimate = 4 (**Using Program CAPTURE**)

Chi Square = 0.000
Pop Est Standard Err = 0.000
Lower Conf Interval = 4.000
Upper Conf Interval = 5.000

Capture Probability = 0.9999

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 3.00.

Stream: Mammoth Creek, Site CH, 9 October 2008
Species: Rainbow trout (hatchery)

Removal Pattern: 3 0 0
Total Catch   =   3
Population Estimate   =   3 (**Using Program CAPTURE**)

Chi Square   =   0.000
Pop Est Standard Err   =   0.000
Lower Conf Interval   =   3.000
Upper Conf Interval   =   4.000

Capture Probability   =   0.9998

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 2.00.

Stream: Mammoth Creek, Site CH, 9 October 2008
Species: Brown trout

Removal Pattern: 46 10 5
Total Catch   =   61
Population Estimate   =   62

Chi Square   =   1.244
Pop Est Standard Err   =   1.437
Lower Conf Interval   =   61.000
Upper Conf Interval   =   64.874

Capture Probability   =   0.726
Capt Prob Standard Err =   0.061
Lower Conf Interval   =   0.603
Upper Conf Interval   =   0.849

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 59.12563 .

Stream: Mammoth Creek, Site CL, 9 October 2008
Species: All trout

Removal Pattern: 27 7 3
Total Catch   =   37
Population Estimate   =   37

Chi Square   =   0.732
Pop Est Standard Err   =   1.005
Lower Conf Interval   =   37.000
Upper Conf Interval   =   39.039

Capture Probability   =   0.740
Capt Prob Standard Err =   0.077
Lower Conf Interval   =   0.583
Upper Conf Interval   =   0.897

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 34.96098 .

Stream: Mammoth Creek, Site CL, 9 October 2008
Species: Rainbow trout (all)

Removal Pattern: 7 0 1
Total Catch   =   8
Population Estimate   =   8

Chi Square   =   3.499
Pop Est Standard Err   =   0.290
Lower Conf Interval   =   8.000
Upper Conf Interval   =   8.686

Capture Probability   =   0.800
Capt Prob Standard Err =   0.145
Lower Conf Interval   =   0.457
Upper Conf Interval   =   1.143

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 7.313583 .

Stream: Mammoth Creek, Site CL, 9 October 2008
Species: Rainbow trout (wild)

Removal Pattern: 1 0 0
Total Catch   =   1
Population Estimate   =   1 (**Using Program CAPTURE**)

Chi Square   =   0.000
Pop Est Standard Err   =   0.000
Lower Conf Interval   =   1.000
Upper Conf Interval   =   2.000

Capture Probability   =   0.9996

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 0.00.

Stream: Mammoth Creek, Site CL, 9 October 2008
Species: Rainbow trout (hatchery)

Removal Pattern: 6 0 1
Total Catch   =   7
Population Estimate   =   7

Chi Square   =   3.256
Pop Est Standard Err   =   0.327
Lower Conf Interval   =   7.000
Upper Conf Interval   =   7.801

Capture Probability   =   0.778
Capt Prob Standard Err =   0.164
Lower Conf Interval   =   0.377
Upper Conf Interval   =   1.178

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 6.199153 .

Stream: Mammoth Creek, Site CL, 9 October 2008
Species: Brown trout

Removal Pattern: 20 7 2
Total Catch = 29
Population Estimate = 29

Chi Square = 0.425
Pop Est Standard Err = 0.991
Lower Conf Interval = 29.000
Upper Conf Interval = 31.030

Capture Probability = 0.725
Capt Prob Standard Err = 0.090
Lower Conf Interval = 0.540
Upper Conf Interval = 0.910

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 26.97 .

Stream: Mammoth Creek, Site DH, 10 October 2008
Species: All trout

Removal Pattern: 60 6 4
Total Catch = 70
Population Estimate = 70

Chi Square = 4.969
Pop Est Standard Err = 0.628
Lower Conf Interval = 70.000
Upper Conf Interval = 71.253

Capture Probability = 0.833
Capt Prob Standard Err = 0.045
Lower Conf Interval = 0.744
Upper Conf Interval = 0.923

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 68.74655 .

```
Stream:  Mammoth Creek, Site DH, 10 October 2008
Species:  Rainbow trout (all)

Removal Pattern:   12  2  1
Total Catch           =    15
Population Estimate    =    15

Chi Square            =     0.531
Pop Est Standard Err   =     0.435
Lower Conf Interval    =    15.000
Upper Conf Interval    =    15.933

Capture Probability    =     0.789
Capt Prob Standard Err =     0.109
Lower Conf Interval    =     0.556
Upper Conf Interval    =     1.023

The population estimate lower confidence interval was set equal
to the total catch.  Actual calculated lower CI was  14.06696 .
```

```
Stream:  Mammoth Creek, Site DH, 10 October 2008
Species:  Rainbow trout (wild)

Removal Pattern:   5  1  0
Total Catch           =     6
Population Estimate    =     6

Chi Square            =     0.205
Pop Est Standard Err   =     0.142
Lower Conf Interval    =     6.000
Upper Conf Interval    =     6.366

Capture Probability    =     0.857
Capt Prob Standard Err =     0.142
Lower Conf Interval    =     0.491
Upper Conf Interval    =     1.223

The population estimate lower confidence interval was set equal
to the total catch.  Actual calculated lower CI was  5.633697 .
```

Stream: Mammoth Creek, Site DH, 10 October 2008
Species: Rainbow trout (hatchery)

Removal Pattern: 7 1 1
Total Catch   =   9
Population Estimate   =   9

Chi Square   =   1.084
Pop Est Standard Err   =   0.461
Lower Conf Interval   =   9.000
Upper Conf Interval   =   10.062

Capture Probability   =   0.750
Capt Prob Standard Err =   0.154
Lower Conf Interval   =   0.396
Upper Conf Interval   =   1.104

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 7.937934 .

Stream: Mammoth Creek, Site DH, 10 October 2008
Species: Brown trout

Removal Pattern: 48 4 3
Total Catch   =   55
Population Estimate   =   55

Chi Square   =   4.713
Pop Est Standard Err   =   0.487
Lower Conf Interval   =   55.000
Upper Conf Interval   =   55.977

Capture Probability   =   0.846
Capt Prob Standard Err =   0.049
Lower Conf Interval   =   0.748
Upper Conf Interval   =   0.944

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 54.0229 .

Stream: Mammoth Creek, Site DL, 10 October 2008
Species: All trout

Removal Pattern: 29 3 2
Total Catch   =   34
Population Estimate   =   34

Chi Square   =   2.396
Pop Est Standard Err   =   0.456
Lower Conf Interval   =   34.000
Upper Conf Interval   =   34.928

Capture Probability   =   0.829
Capt Prob Standard Err =   0.065
Lower Conf Interval   =   0.697
Upper Conf Interval   =   0.962

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 33.07202 .

Stream: Mammoth Creek, Site DL, 10 October 2008
Species: Rainbow trout (all)

Removal Pattern: 17 2 1
Total Catch   =   20
Population Estimate   =   20

Chi Square   =   0.848
Pop Est Standard Err   =   0.336
Lower Conf Interval   =   20.000
Upper Conf Interval   =   20.703

Capture Probability   =   0.833
Capt Prob Standard Err =   0.084
Lower Conf Interval   =   0.658
Upper Conf Interval   =   1.009

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 19.29709 .

Stream: Mammoth Creek, Site DL, 10 October 2008
Species: Rainbow trout (wild)

Removal Pattern: 16 2 1
Total Catch   =   19
Population Estimate   =   19

Chi Square   =   0.783
Pop Est Standard Err   =   0.352
Lower Conf Interval   =   19.000
Upper Conf Interval   =   19.739

Capture Probability   =   0.826
Capt Prob Standard Err =   0.088
Lower Conf Interval   =   0.641
Upper Conf Interval   =   1.011

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 18.26108 .

Stream: Mammoth Creek, Site DL, 10 October 2008
Species: Rainbow trout (hatchery)

Removal Pattern: 1 0 0
Total Catch   =   1
Population Estimate   =   1 (**Using Program CAPTURE**)

Chi Square   =   0.000
Pop Est Standard Err   =   0.000
Lower Conf Interval   =   1.000
Upper Conf Interval   =   2.000

Capture Probability   =   0.9996

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 0.00.

```
Stream:  Mammoth Creek, Site DL, 10 October 2008
Species:  Brown trout

Removal Pattern:   12  1  1
Total Catch           =    14
Population Estimate    =    14

Chi Square            =     1.690
Pop Est Standard Err   =     0.309
Lower Conf Interval    =    14.000
Upper Conf Interval    =    14.668

Capture Probability    =     0.824
Capt Prob Standard Err =     0.103
Lower Conf Interval    =     0.601
Upper Conf Interval    =     1.046

The population estimate lower confidence interval was set equal
to the total catch.  Actual calculated lower CI was  13.33155 .
```

```
Stream:  Mammoth Creek, Site EH, 11 October 2008
Species:  All trout

Removal Pattern:   78  23  9
Total Catch           =   110
Population Estimate    =   113

Chi Square            =    0.334
Pop Est Standard Err   =     2.525
Lower Conf Interval    =   110.000
Upper Conf Interval    =   117.999

Capture Probability    =     0.688
Capt Prob Standard Err =     0.049
Lower Conf Interval    =     0.590
Upper Conf Interval    =     0.785

The population estimate lower confidence interval was set equal
to the total catch.  Actual calculated lower CI was  108.001 .
```

```
Stream:  Mammoth Creek, Site EH, 11 October 2008
Species:  Rainbow trout (all)

Removal Pattern:   12  8  2
Total Catch           =    22
Population Estimate    =    23

Chi Square            =     1.334
Pop Est Standard Err   =     2.027
Lower Conf Interval    =    22.000
Upper Conf Interval    =    27.203

Capture Probability    =     0.595
Capt Prob Standard Err =     0.129
Lower Conf Interval    =     0.327
Upper Conf Interval    =     0.863

The population estimate lower confidence interval was set equal
to the total catch.  Actual calculated lower CI was  18.79657 .
```

```
Stream:  Mammoth Creek, Site EH, 11 October 2008
Species:  Rainbow trout (wild)

Removal Pattern:   1  6  2
Total Catch           =     9
Population Estimate    =    40

Chi Square            =     4.851
Pop Est Standard Err   =   173.254
Lower Conf Interval    =     9.000
Upper Conf Interval    =   390.493

Capture Probability    =     0.080
Capt Prob Standard Err =     0.378
Lower Conf Interval    =     -.685
Upper Conf Interval    =     0.846

The population estimate lower confidence interval was set equal
to the total catch.  Actual calculated lower CI was -310.4928 .
```

```
Stream:  Mammoth Creek, Site EH, 11 October 2008
Species:  Rainbow trout (hatchery)

Removal Pattern:   11  2  0
Total Catch           =    13
Population Estimate    =    13

Chi Square            =     0.372
Pop Est Standard Err   =     0.187
Lower Conf Interval    =    13.000
Upper Conf Interval    =    13.408

Capture Probability    =     0.867
Capt Prob Standard Err =     0.094
Lower Conf Interval    =     0.662
Upper Conf Interval    =     1.071

The population estimate lower confidence interval was set equal
to the total catch.  Actual calculated lower CI was  12.59159 .
```

```
Stream:  Mammoth Creek, Site EH, 11 October 2008
Species:  Brown trout

Removal Pattern:   66  15  7
Total Catch           =    88
Population Estimate    =    89

Chi Square            =     1.545
Pop Est Standard Err   =     1.636
Lower Conf Interval    =    88.000
Upper Conf Interval    =    92.252

Capture Probability    =     0.733
Capt Prob Standard Err =     0.051
Lower Conf Interval    =     0.633
Upper Conf Interval    =     0.834

The population estimate lower confidence interval was set equal
to the total catch.  Actual calculated lower CI was  85.74834 .
```

Stream: Mammoth Creek, Site EL, 11 October 2008
Species: All trout

Removal Pattern: 65 10 3
Total Catch = 78
Population Estimate = 78

Chi Square = 0.772
Pop Est Standard Err = 0.687
Lower Conf Interval = 78.000
Upper Conf Interval = 79.369

Capture Probability = 0.830
Capt Prob Standard Err = 0.043
Lower Conf Interval = 0.744
Upper Conf Interval = 0.915

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 76.6312 .

Stream: Mammoth Creek, Site EL, 11 October 2008
Species: Rainbow trout (all)

Removal Pattern: 16 2 1
Total Catch = 19
Population Estimate = 19

Chi Square = 0.783
Pop Est Standard Err = 0.352
Lower Conf Interval = 19.000
Upper Conf Interval = 19.739

Capture Probability = 0.826
Capt Prob Standard Err = 0.088
Lower Conf Interval = 0.641
Upper Conf Interval = 1.011

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 18.26108 .

Stream: Mammoth Creek, Site EL, 11 October 2008
Species: Rainbow trout (wild)

Removal Pattern: 15 2 1
Total Catch = 18
Population Estimate = 18

Chi Square = 0.718
Pop Est Standard Err = 0.369
Lower Conf Interval = 18.000
Upper Conf Interval = 18.779

Capture Probability = 0.818
Capt Prob Standard Err = 0.092
Lower Conf Interval = 0.623
Upper Conf Interval = 1.013

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 17.22094 .

Stream: Mammoth Creek, Site EL, 11 October 2008
Species: Rainbow trout (hatchery)

Removal Pattern: 1 0 0
Total Catch = 1
Population Estimate = 1 (**Using Program CAPTURE**)

Chi Square = 0.000
Pop Est Standard Err = 0.000
Lower Conf Interval = 1.000
Upper Conf Interval = 2.000

Capture Probability = 0.9996

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 0.00.

Stream: Mammoth Creek, Site EL, 11 October 2008
Species: Brown trout

Removal Pattern: 49 8 2
Total Catch   =   59
Population Estimate   =   59

Chi Square   =   0.268
Pop Est Standard Err   =   0.591
Lower Conf Interval   =   59.000
Upper Conf Interval   =   60.182

Capture Probability   =   0.831
Capt Prob Standard Err =   0.049
Lower Conf Interval   =   0.732
Upper Conf Interval   =   0.930

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 57.81772 .

Stream: Mammoth Creek, Site EL, 11 October 2008
Species: Owens sucker

Removal Pattern: 8 3 0
Total Catch   =   11
Population Estimate   =   11

Chi Square   =   1.157
Pop Est Standard Err   =   0.384
Lower Conf Interval   =   11.000
Upper Conf Interval   =   11.856

Capture Probability   =   0.786
Capt Prob Standard Err =   0.128
Lower Conf Interval   =   0.500
Upper Conf Interval   =   1.071

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 10.14356 .

Stream: Mammoth Creek, Site EL, 11 October 2008
Species: Tui chub (hybrid)

Removal Pattern: 3 2 0
Total Catch   =   5
Population Estimate   =   5

Chi Square   =   1.326
Pop Est Standard Err   =   0.444
Lower Conf Interval   =   5.000
Upper Conf Interval   =   6.231

Capture Probability   =   0.714
Capt Prob Standard Err =   0.222
Lower Conf Interval   =   0.099
Upper Conf Interval   =   1.330

The population estimate lower confidence interval was set equal to the total catch. Actual calculated lower CI was 3.768828 .